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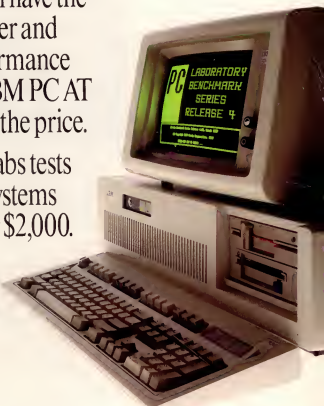
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**PC LAB NOTES:  
MASTERING YOUR  
LASER PRINTER****MAGAZINE**VOLUME 7 NUMBER 3  
FEBRUARY 16, 1988

# Why Pay More?

You can have the  
power and  
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of the IBM PC AT  
for half the price.

PC Labs tests  
21 systems  
under \$2,000.



- Moving Up to VGA:  
The First 5 Add-in Cards
- Saving on Spreadsheets:  
14 Bargain Programs
- Top-of-the-Line Mice  
from Microsoft  
and Logitech







record used by Intr and MsDos )

```
record
  case Integer of
    0: (AX, BX, CX, DX, BP, SI, DI, DS, ES, Flags: w
    1: (AL, AH, BL, BH, CL, CH, DL, DH: Byte);
  end;
```

and untyped-file record )

```
record
  Handle: Word;
  Mode: Word;
  RecSize: Word;
  Private: array[1..26] of Byte;
  UserData: array[1..16] of Byte;
  Name: array[1..79] of Char;
```

Program in the  
fast lane with  
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Customers have also told us our intelligently staffed Toll-Free Technical Hot Line is a stroke of genius (it's so good, people using other monitor makes have asked for help—we did our best).

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Glenn Hart, *PC Magazine*  
May 12, 1987, Page 36.

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William G. Harrington,  
*The National Law Journal*  
June 29, 1987, Page 14.

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VOLUME 7 NUMBER 3

# WHAT'S INSIDE

Some PC users want the utmost power—and will pay any price. These are the people buying the hottest new 386 and PS/2 machines. But many of our readers want power at a bargain price.

If you're one of these people, you'll want to consider the 21 286 machines reviewed in "The Cheapest ATs Ever," page 93. All sell for less than \$2,000—including a hard disk, video card, and monitor—or less than half the price of the Big Blue variety of AT.

Most of these machines are assembled and sold by mail-order companies (and we give you tips on how to navigate that channel). But you may not realize that you can find name-brand machines, from companies such as AST, Epson, Tandy, and NEC, in the same under-\$2,000 price range. You can often find such bargains as easily as reading your local paper, and you may feel more comfortable buying from a name-brand company.

Which goes to show that while it's often true that you get what you pay for, a little digging can turn up some true bargain gems. Assistant editor Donald P. Willmott headed the team of sleuths who unearthed surprises in under-\$2,000 ATs that include OS/2 support, 12-MHz clock speed, 40MB hard disks, and free EGA display adapters.

Once you've got your AT, you may want to add on another input device. If that's the case, you should check out the latest mice from Logitech and Microsoft, reviewed in "From Our Maus to Baumaus: Logitech Versus Microsoft," page 201. One offers maximum resolution; the

other, a comfortable ergonomic design.

You'll find other inexpensive gems in "Spreadsheets for Modest Proposals," page 261. These products typically offer all of the essential spreadsheet features and functions—all for under \$200, some for less than \$50.

While this issue highlights lots of bargains, we haven't neglected to cover hot technology. In "VGA Compatibles: Gaining on the New Standard," page 175, PC Labs benchmark-tests the first five VGA-compatible add-in boards to hit the scene, bringing that standard's 256 colors to your existing PC.

In PC Lab Notes, Caroline Halliday shows you how to master your laser printer in the first of her three-part series. And for those times when DOS's PATH command just isn't enough, Michael J. Mefford's RUN.COM utility helps you execute even your most displaced programs.

After Hours focuses on educational programs that help preschoolers learn simple words and numbers, give teenagers practice with algebra concepts, and help college students prepare for the business graduate school admission test.



Assistant editor Donald P. Willmott headed the team that discovered some real bargains in AT-class machines under \$2,000.

PC Magazine, The Independent Guide to IBM Standard Personal Computer (PS/2) is published bi-weekly except in July and August for \$9.95 for one year (12 issues). \$6.95 for two years and \$6.95 for three years. Additional postage \$1.00 per copy in U.S. Wherever your local dealer and all other foreign countries. Call: Data Publishing Co., a division of Ziff Communications Co., One Park Ave., New York, NY 10016. Second-class postage paid in New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to PC Magazine, P.O. Box 5489, Boulder, CO 80521-0489.



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## COVER STORY

**The Cheapest ATs Ever**  
*Alfred Poor!* Today, it's a buyer's market for AT-compatible machines. The increased competition in the 80286-based-computer marketplace has pushed prices down to levels that would once have been attractive for an 8088-based machine. So if you're looking for a system fully equipped with a monochrome monitor, video card, and hard disk—and you've got between \$1,200 and \$2,000 to spend—one of the 21 low-cost clones reviewed here might be your best bet ..... 93



Microsoft and Logitech mice lead the pack. .... page 201.

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**Cover Photograph:**  
Roberto Brosan



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### FEATURES

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Each issue of PC Magazine contains free programs, tutorials, notes, and applications advice to help our readers gain technical proficiency. We're very interested in receiving user tips (on disk, please) and are eager to hear from assembly language programmers who can help us develop useful PC Magazine utilities. Unfortunately, because of the large volume of mail, we can't acknowledge or respond to all submissions. Contact: Paul Somerson, Executive Editor, Robert L. Hummel, Senior Technical Editor

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Stephen Manes, PC Magazine

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PC BusinessSoftware (Rated #1)

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Don A. Griffin

The Newsletter of the AutoCAD User's Group

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Ted Mirecki, PC Tech Journal (Rated #1)

"The 12-MHz Breakthru 286-12 speedup board is the fastest of those tested, but not the most expensive. On a dollar per horsepower basis, it could be called the cheapest board available for an XT."

Mark Veach, InfoWorld (Rated #1)

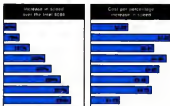
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First, they install so easily. A half-slot card means you don't even have to give up a full slot. What's more, unlike competing

products it works in the Compaq Portable and most clones. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

Second, they are advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. Has a 80287 math coprocessor slot for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Speed switching software allows you to drop back to a lower speed on the fly for timing sensitive applications.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Faster and smarter than an AT - PCSG guarantees it.

Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, PC

Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the \$89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.

But, no speedup board could disk access time in half

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"Lightning is almost mandatory..." - Steve Manes, PC Magazine Best of 86 review

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**Don't take our word for it. Use Lucid 3-D for 60 days. Return it for a full refund if not completely satisfied. Plus, instead of the \$199 list price, an introductory spread-the-word price of \$99.**

Lucid 3-D is priced to sell at \$199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only \$99, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

## Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word

way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "Lucid 3-D is how software of the 1990's will look and perform", or even more to the point "This is the way I thought a computer should work". You'll see, Lucid is exciting.

way. Users say "It is so intuitive that I really don't need a manual." That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "If there ever was an interface idea so good it ought to be stolen and widely used, this is it."

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recog-



FIG. 2 Here we are. Instantly. Notice the lower left corner showing we are on level 2. You can go down or up. (See next page)

processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the

multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that. All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that

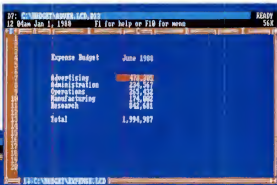
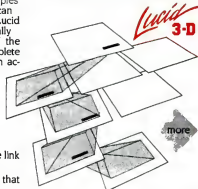


FIG. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (grey +).

## What Makes it so Special

In the screen examples you can see Lucid is really

nize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.



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**Any cell can contain a complete other spreadsheet that you can access with a single key.**

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

## Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write



FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

### Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

## Lucid Learns

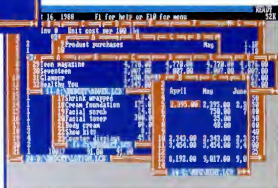
Lucid 3-D also lets you teach it any



FIG. 3 We want more detail, so let's go to Newspapers, just press the Grey + Key

**“The best idea I’ve seen for a spreadsheet in years.”**

Jim Seymour, Columnist, PC Magazine, PC Week



**Fig. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else can do that.**

### Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.



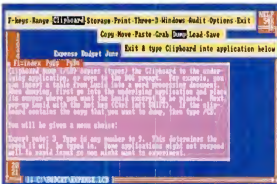


FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

#### Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts.

#### Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a master-



Makers of **LIGHTNING**  
disk speed up software, and  
**BREAKTHRU 286** Accelerator Board.

FIG. 7 Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.



work. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC Magazine, used one word to describe it, "Slack".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced **LIGHTNING** the pioneer and award winning Disk speed up software. In 1986 we developed the **BREAKTHRU 286** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "you have done it again. This is software everyone should have."

**Lucid**  
**3-D**

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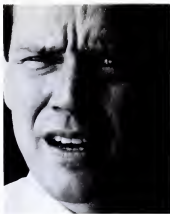
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**1:24:** *"They want the report in the morning. I'll be here all night."*



**3:47:** *"This is going too fast. I must be forgetting something."*



**5:05:** *"Having saved the day again, our hero rides off into the sunset."*



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# LETTERS TO PC MAGAZINE



## PRINTER PERCEPTIONS

A great and timely review of printers! ("The 4th Annual All-Printer Review," *PC Magazine*, November 10, 1987.) It ar-



rived just as I was considering the purchase of a new 24-pin color printer.

I am a bit confused, however, about the draft print samples given for each printer. Were they taken from a new ribbon or a multistrike after multipages? The samples made some printers look as if they were in need of repair (including the one I was considering). Can you elucidate?

John Buffum  
Leavenworth, Kansas

*All print samples were created with new ribbons. However, most printers let you adjust the ribbon-to-printhead distance, so differences in this adjustment among the 106 printers tested may have caused some samples to appear slightly lighter or darker than others.*

Bruce Brown, in reviewing (or advertising?) the Epson 24-pin printers, asks, "Why spend more for printers that can do only slightly better when you can have the high-quality LQ-850 and LQ-1050 without the high cost?" ("The 4th Annual All-Printer Review.") I can name two reasons: one, the breakdown rate on the Epson LQs

is the worst in the industry; and two, they have type that, although well formed, is far too faint, requiring double strike to get acceptable output.

Don Holmes  
Hayward, California

*Dot matrix printers tend to be very reliable. We're not aware of any problem with Epson LQs in particular.*

*Print quality that grows fainter over the life of a ribbon is a problem common to all dot matrix printers. It's worse on 18- and 24-pin printers. As we mentioned in the introduction to the dot matrix printer reviews, "Dot Matrix: The Jack-of-All-Printers," each pin on an 18- or 24-pin printer has about half the surface area of a 9-pin printer pin. Less surface area translates to less ink transferred from ribbon to paper and a fainter printed image. For those important letters, use a one-shot mylar ribbon (sometimes called a carbon ribbon) if your printer has one available.*

Your recent printer issue ("The 4th Annual All-Printer Review") failed to address one issue I have found quite important: tractor location—front mounted, rear mounted, or concentric with the platen.

Printer engineers seem to be stuck on the idea that a printer should look like a typewriter. Surely a printer could be constructed so that the paper would pass straight through the machine without needing to reverse directions and cause tractor-jamming, 180-degree curls. I see no inherent layout difficulties enforcing this design; in fact, for convenience, the paper should load from the front and accumulate in back.

Chatwin Lansdowne  
Wichita, Kansas

The 1987 annual printer issue shed considerable light on the direction the printer manufacturers are taking ("The 4th Annual All-Printer Review"). Since I am in the market for a replacement to my aging, and no-longer-supported, Epson MX-80, I intend to take the advice of the editors and purchase the Panasonic KX-P1091i—after finding that "well-known discounter (selling it) for \$100 less."

On the other hand, please pass the following message on to the makers of laser printers: I'll wait to buy a laser printer until I can purchase a PostScript printer for \$2,000. In other words, when Adobe brings its royalty fee down to earth, I'll take the laser dive. Until then, I'll make do with my slow daisy wheel printer for correspondence and my Panasonic for graphics. Think about it, Adobe; if every laser printer were PostScript compatible, a small royalty fee would add up to a lot more than the few large royalties you're getting now.

Dr. Stephen A. Risik  
York, Pennsylvania

To all the laser printer wish lists appearing in your magazine ("What's Wrong with Lasers," From the Editor's Screen, *PC Magazine*, October 13, 1987; "Lasers: A New Standard," *PC Magazine*, November 10, 1987), I would like to add one





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## VIEWPOINTS

### LETTERS

item: a switch that powers-down the non-electric components but lets the RAM retain downloaded fonts from day to day. Downloading the same fonts every morning has a way of destroying any illusions one might have of being a "power user."

P. Dutta  
Evanston, Illinois

I found the tone of your review of Data Technology's Crystal Print VIII to be unjustifiably negative ("Lasers: A New Standard"). To me, this is the most significant product announcement in computer printers since the laser. While it may not be a functional improvement, there is every indication that this technology should be inherently more reliable than the laser; if this is not a revolutionary step, then it is certainly an evolutionary one. While I understand your reticence to recommend an unproven product, particularly to low-volume users, large corporations should be encouraged to purchase evaluation units.

They should not be frightened away from a technology that, in my opinion, has a good chance of replacing the laser printer.

Bob Stolarz  
Montclair, New Jersey

### UNFOUNDED CRITICISM

Thank you for including the IOC Reader in your review of scanners and OCRs ("Scanners Take Off," *PC Magazine*, October 13, 1987). While we appreciate your efforts to provide your readers with accurate product reviews, we found references regarding the IOC Reader's capabilities that were both misleading and simply not true.

Regarding your criticism of the IOC's use of AN-SI.SYS, we chose to use this optional program since many of our users are primarily OCR users and are not interested in graphics-based functions. With the wide variety of DOS computers around, this approach allows the IOC to interface any DOS-compatible host computer without transporting hardware.

Another unfounded criticism concerned

the IOC's paper feed. The IOC's paper feed is modeled after the paper feed of a facsimile transceiver. The feed allows for easy placement of pages ranging in size from 5 to 10 inches. We cannot fathom how this easy-to-use feature could be construed as anything other than a convenience, rather than the monstrosity indicated by your reviewer.

Finally, your reviewer criticized the IOC's graphics capabilities for their speed alone. The IOC supports RS-232, RS-422, and a proprietary DMA to achieve a speed appropriate to the quality of image processing required by the customer. Your test conducted gray-scale processing using the RS-232 option—a slow implementation. The appropriate implementation for this test would have used the RS-422 or DMA option.

Mark Bovino  
Intelligent Optics Corp.  
Clinton, Connecticut

### IN THE NAME OF LOTUS

How ironic that Lotus has renounced copy protection for future products (First Looks, page 33, *PC Magazine*, November 24, 1987). Litigation has made the "look and feel" of the Lotus Development Corp. repulsive. No need to worry about pirates; Lotus may end up giving away copies of 1-2-3. To be perfectly "Lucid," the competition will "Excel" and "Surpass" it by more than a factor of "Quattro"! Lotus should "Speedup" and "Learn" something: the reputation of a company is the best enhancement to its product.

Simon Montalvo  
Fort Wayne, Indiana

### A TERMINAL OPINION

I have found your reviews and opinions of products to be of great value in choosing (and avoiding) software and hardware. In addition, I especially enjoy reading the antic notions of John C. Dvorak; one seldom encounters literacy among the terminally opinionated.

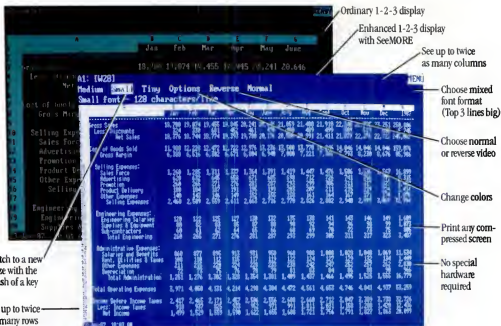
Frederick Earl Upchurch  
Gastonia, North Carolina

### READER SUPPORT

After reading the letter from John Bales of Gaithersburg, Maryland (Letters to *PC Magazine*, November 10, 1987), I was







Switch to a new size with the push of a key

See up to twice as many rows

Unretouched photo of EGA display

# 1-2-3 never looked so good.

Introducing SeeMORE™, a powerful screen manager for 1-2-3® that expands your worksheet view with the push of a key. SeeMORE gives you a choice of compressed formats that double, triple or quadruple the number of cells displayed on the screen.

Install the SeeMORE program with 1-2-3 and you can build a twelve month forecast without stopping to scroll around. All twelve months appear on the screen. SeeMORE lets you see the *big picture*.

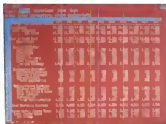


Switch to reverse video.

No special hardware is required to run SeeMORE. All you need is a CGA, EGA, VGA, Hercules or compatible graphics adapter.

SeeMORE manages the screen *without* interfering with the normal operation of 1-2-3. You can zoom in and out as you

build and manipulate a worksheet – you don't need to exit 1-2-3 and switch to a new driver set! And SeeMORE lets you produce hardcopy printouts of any compressed screen with the push of a key.



Change background and foreground colors.

Get SeeMORE and expand your horizons. Works with 1-2-3 Rel 2 on the IBM PC, XT, AT, PS/2 and compatibles. \$79.95. Not copy protected. Symphony version coming soon.

	CGA	EGA/VGA	Hercules
Normal	80 x 25	80 x 25	80 x 25
SeeMORE:			
• Medium	91 x 28	106 x 43	120 x 43
• Small	106 x 33	128 x 43	144 x 43
• Tiny	128 x 33	160 x 58	180 x 58

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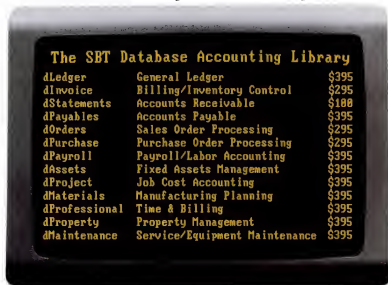
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## ■ LETTERS

pleased to see that someone was able to bring to your attention the problems that could occur with disk optimizing programs. Winn L. Rosch's response was excellent, and I hope that readers take heed.

Michael A. Currau  
Factoryville, Pennsylvania

Your KEYSUB routine in the November 10, 1987, issue of *PC Magazine* is great (PC Tutor), but you have a much better answer to the problem posed by your reader, Derek Howard. I refer you to your program DATAMAKE.BAS, listed in the October 29, 1985, issue (User-to-User). This program, along with touch typing on the number pad, makes converting from your BASIC listings to .COM files easy.

Glenn Ralston  
Jacksonville, Florida

## KEYBOARD SATISFACTION

I was disappointed to read a continuing series of complaints regarding the new IBM Enhanced Keyboard most recently in Jim Seymour's column ("Better User Interfaces," *PC Magazine*, November 10, 1987). Is there no one else who is satisfied with this keyboard style? As a newcomer to personal computing who nevertheless has two computers and three keyboards, I must speak up for the elegance and convenience of the enhanced style.

Although those long familiar with the older keyboards may find it difficult to adjust and will lament the lack of choice from IBM, I believe that there is a place for the new keyboard. And since there are a num-

ber of keyboard redefinition utilities available, the energetic criticism might be more profitably directed elsewhere.

Constantine Hannaher  
Arlington, Virginia

*It's true, much of the criticism comes from writers who were comfortable with the old keyboard. But difficulties plague everyone who uses programs that use Alt- and Ctrl-function key combinations.*

## CORRECTIONS/AMPLIFICATIONS

Matchups, maker of the word game *Tyler* (After Hours, *PC Magazine*, November 24, 1987), is located at 16 Oak Rd., Medford, MA 02155.

The correct address for Koch Software (Inside Track, *PC Magazine*, November 24, 1987) is 11 W. College Dr., Bldg. G, Arlington Heights, IL 60004.

## HOW TO WRITE TO PC MAGAZINE

Do you have a comment, compliment, or criticism about something you've read in *PC Magazine*? A question you'd like to open up to other readers? Then send your opinion to Letters to *PC Magazine*, One Park Avenue, New York, NY 10016, or through MCI Mail to PCMAGAZINE.

All letters become the property of *PC Magazine* and are subject to editing. We cannot publish letters that do not include a name, address, and phone number for verification. We're sorry we're not able to answer letters personally.

## Alps ALQ300

GRAPHICS  
SAMPLES

TEXT  
SAMPLES



Our constitution is in actual operation; everything appears to promise that it will last; but in this world nothing is certain but death and taxes. -  
Draft Bold Underline Compressed *Italic*  
Elite Bold Underline Compressed *Italic* Compressed  
Proportional Bold Underline Compressed *Italic* C

The actual output of the Alps ALQ300 (Epson LQ-1500 emulation) as it should have appeared on page 114 in "The 4th Annual All-Printer Review," *PC Magazine*, November 10, 1987.

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# 10 BIG REASONS IT'S TIME YOU CHANGED YOUR EDITOR TO BRIEF

**1 FUNDAMENTAL TRUTH.** If you are a programmer, you use your editor more than any other tool. If it isn't the best, the fastest, the most versatile, the most productive...well, then neither are you!

**2 OUR ENTHUSIASM.** While we do not publish BRIEF we wish we did. We sell so many BRIEFs that we've been advertising it non-stop since it was introduced two years ago. We're not alone in our enthusiasm. There is no end of accolades from other admirers.

## This Month's Feature Attraction!!

### UNDO, NOT UNDELETE

Chances are you don't know how much of a lifesaver BRIEF's Undo really is. Praise the profession of editors with an "Un-Delete" capability has lowered your expectations?

Brief has something that the plethora of other editors do not have. A real Undo command that doesn't just recover your most recent accidental deletion. It undoes all accidents. You can undo any command that affects the cursor or the text (for example a global replace). And keep undoing up to 30 times, even back to the beginning of your session.

"High on the list of the editors distinguishing features is an Undo capability that goes much beyond the mere Undoable command by most other editors. This capability offers much more than insurance against mistakes; experienced users soon learn to use it as a navigational feature. For example after journeying into the depths of a file with the search command, the user may wish Undo to quickly return the cursor to the original point."

Ted Merenda, Product Watch, pg 189, PC Tech Journal, October 1987

**3 WINDOWS ON THE WORLD.** Why the excitement? First, BRIEF's architecture. Any number of files of virtually any length can be open. (Start BRIEF with `*.*` to open `z:`). Open as many tiled windows as fit the screen—over/under and side-by-side—to work on any of your files. Open, close, and resize windows as you go. In each window, full screen or tiled, all editing techniques are at hand—high-speed scrolling, paging up and down, horizontal cursoring, optional word wrap. Load the same file in any number of windows to view different areas simultaneously. A change in one changes all. Cut and paste text blocks between windows and files, or into buffers for later recall. All files stay in memory, so you can always go back to snip some more.

**4 WHOLLY MACROS.** Much of BRIEF was written in its own macro language. It is that powerful! The language and its compiler come with every copy, as do many standard macros, with source code for learning by example. It is a complete language with conditionals, loops, recursion, global and local variables, even data types. It can control files, windows, and the keyboard. It has structure, 32-character variable names, and—*not at all like 1-2-3*—is entirely readable, like a hybrid of LISP and C. With it you can develop a library of routines to power BRIEF your way.

**5 UNDO, NOT UN-DELETE.** Don't confuse the two. BRIEF doesn't just keep snapshots of recent deletions should you want to pick them up from the cutting room floor. It can reel the whole film backward undoing any command that affected the cursor or the text. Watch it undo a global replace, for example. Uncanny. It can back up 300 times, all the way to the beginning of a session. "Works like a dream," said *The C Journal*.

**6 SHELL GAMES.** Leave BRIEF, run your compiler, print out the error messages, load up BRIEF again? No way! Run your compiler from inside BRIEF. It will point to each error line in your source program, still loaded in memory, for immediate editing. You don't have to leave BRIEF to use DOS either. BRIEF disappears from the screen to get out of your way, but say bye to DOS and BRIEF pops back to the screen, as do all the files you were working on.

**7 KEY WHIZ.** You can reassign BRIEF's command keybats to whatever keys you're used to, even your old editor's, so you don't have to send your fingers back to school. Macro execution can be assigned to single keys. Or you can tell BRIEF to listen while you tap out a complex routine. It will save and playback faithfully, a shortcut macro without a single line of coding.

**8 MULTI-LINGUAL.** BRIEF's macro language is perfect for writing formatters for your language which indent, match up parentheses and brackets, and set up statement templates for fill-in. BRIEF comes with C language support already built in. Others have written macros to format Pascal, BASIC, LISP, Prolog, FORTRAN.

**9 QUICKER PICKER-UPPER.** Looking for something? BRIEF has full UNIX\*-like expression search tools to forage and find and fix any file in memory. Literal strings with wildcards and "?" character masking, sure. But also indifference to case or intervening characters. (aieu) to match all vowels, or (~aeiou) to match anything but vowels, [a-f-e] to match character ranges, beginning or end of line searches, even multiple choice pattern matching and replacement.

**10 REASONS 11 THROUGH 20:** 11. BRIEF comes with a color option. You can select your own color scheme anytime. 12. It supports EGA's 43 line

## dBRIEF. The Power Environment for dBASE Programming

Many worthy utility products supply needs that dBASE's programming language doesn't—dUTILITY, dFLOWTM and a host of others. Trouble is, you have to use them separately, then combine their output into your dBASE program files.

No longer dBRIEF, written in BRIEF's macro language, grabs hold of BRIEF and turns it into a complete dBASE III and III Plus programming domain. Using BRIEF's underlying shell capabilities and its own interfaces, dBRIEF can run external utility libraries, plus dBASE itself, and link to the ClipperTM, Foxbase+TM and Quicksilver complete, all with dBRIEF still loaded and running the show. It can do what BRIEF already does plus:

- Convert a screen layout into dBASE code for interactive data entry.
- Display dBASE file structures in windows, a great convenience alongside your program files.
- Expand keystrokes into full dBASE statements.
- Indent automatically for cleq display.
- Create databases, index files, invoke Ashton-Tate's dFORMATTM and dCONVERTTM, draw lines and boxes.

"Simply marvelous programming environment for writing and editing dBASE programs". PC Magazine, 7/88. Source code included! Requires BRIEF 1.32 or later and 384K. 512K to run dBRIEF within dBRIEF, 640K and harddisk recommended.

mode and can display up to 128 lines long. 13. Full 8-bit ASCII display; the whole character set can show on screen. 14. Full path support. 15. Command line start-up flags to modify BRIEF's behavior, change a path name, or run a macro; for example "wp" which turns BRIEF into a word processor with wraparound and margin setting. 16. Automatic file save during idle moments. 17. Compatibility with most stay-resident programs (like SidekickTM), multitaskers (like Microsoft WindowsTM), and networks. 18. A bulletin board with public domain macros contributed by a mushrooming cult of macromaniacs. 19. No copy protection. 20. Context sensitive help, and phone support from the publisher.

\* Brief needs 18Ks memory, 320K for compile feature. \*Product must be returned in resalable condition.

**NEW VERSION 2.0!** Support for more languages • Regular expressions match over multiple lines • Faster undo & expression search • Added types of block marking • Optional borderless windows • Supports displays with 127 lines, 255 chars • New documentation with tutorials on regular expressions and macros • **30 DAY** money-back guarantee for products in resalable condition.

## 800 PC-BRAND

List Prices: BRIEF: \$195. dBRIEF: \$95  
BRIEF/dBRIEF Combination: \$275.

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## SUPER SOURCE

### Aldebaran's Source Print

Author Alan Sampson writes "the best overall debugging technique is to draw lines to connect all the IF and DO WHILEs etc. with their ENDIF and ENDDO. Then use a pencil to..." Well, thanks, Alan, but we'll use Source Print instead. It draws those vertical lines to connect the beginning and endings of structure in a vivid display of your program's organization. It can print your programs with page numbers, headings, line numbers, listed automatically. It prints a table of contents and cross-reference index. Occasionally a utility comes along that makes a programmer's life much easier. Source Print is such a program, says PC Magazine. List \$97, Ours \$75.

### ...and Tree Diagrammer

Tree Diagrammer prints an organization chart of your program's structure showing the hierarchy of function, procedure, and subroutine calls. Store it in a place where you call it each other for clearer debugging. Every shop should have this important documentation tool. List \$77, Ours \$67.

## C-TREE & N-TREE

### B-Tree File Manager Now Has Report Generator

**c-tree:** The only major b-tree file manager with network support in the standard code versions of c-tree lets you add network locking routines for DOS 3.1, 2.1, UNIX and XENIX, and it even comes in C source code, yet there are no royalties. Source sticks to K&R, so C-tree is portable. Tests in many environments pass.

Permits a number of keys for a data file—alpha, numeric, even floating point. Handles files with varied record lengths, multiple levels in one index file. Both high level and decompiled functions. It's the works.

**n-tree:** Adds the ability to produce ad hoc reports from files maintained by c-tree by 4.1 and up. Link a file description to the c-tree's N library, and use any text editor to write report scripts with no further C coding. Reports can access data in several files, select on criteria, join fields into new fields and new tables, calculate new fields and columns, substitute by control breaks. Comes in source, same portability as c-tree, and fits any computer.

	List	Ours
c-tree	\$386	\$249
n-tree	\$295	\$249

Combined

\$341

## WINDOWS FOR DATA

FIRST PRIZE!

### M'Soft Windows Compatible

Only one package can be easily recommended: **and Computer Language (now 87)** reviewing new window and data entry products for C. Complete level level functions specify program, field length, data type, screen location, picture, target variable, entry rules, help messages, even routines to call for validation once data keyed in.

Windows for C is a subset. No data entry but all windowing functions. Unlimited windows can be made either to pop up or permanently over the screen, scroll and highlight lists vertically and horizontally. Speedy Complete Windows for Data. List \$895, Ours \$299. Windows for C. List \$126, Here \$141.

## ESSENTIAL C

### UTILITY LIBRARY

**400 Functions, 30c Each**  
You've probably seen the speed and power of Essential's C function library without knowing it. Software greaves have been using it for some time, and for today's top products, please are attached.

New grown to 400 functions, Essential produces pop-up menus, screens and tables, and even windows to draw or memory in as little as 1/100 second, and claims the fastest video output available. Library has 50 business graphics functions, 40 string functions, 28 functions for graphics, 35 for math, 11 for time and date, DOS interface functions for disk error trapping, directory and file creation and management, lists more. Everything in source, including sample programs. We have versions with pre-built libraries for the well-known C compilers, and a source code librarian is supplied for rolling your own.

C Utility Library	\$185	\$119
Essential Graphics	\$290	\$183
Essential Communications	\$185	\$125
with Breakout Debugger	\$290	\$189

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PROLOG Compiler & Interpreter	650	489						
Artty File or Screen Display Toolkits	50	49	COBOL LANGUAGE					
SOL Development Package	295	229	RMICOBOL, see Ryan McI artand Prod	700	499			
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QUICKREPORT is a full-featured relational report writer, which combines up to 6 databases in one report, handles many-to-one relations, fancy printer features (line bold and italic), computed fields, and up to 16 levels of totaling and sorting.

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Relational applications that read, display, and update a dozen or more databases simultaneously.

"Real-time" calculations performed on screen as the user enters each field.

Format up to 11 screens long, with the ability to pass data between screens.

Computational formulas that automatically combine data from different databases.

9 Data types, 16 field types.

QUICKREPORT is a full-featured relational report writer, which combines up to 6 databases in one report.

Handles many-to-one relations, fancy printer features (line bold and italic), computed fields, and up to 16 levels of totaling and sorting.

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## WALLSOFT'S THE UI PROGRAMMER

### Code generator for dBASE

The UI Programmer was developed for professional dBASE programmers who have been frustrated in the past by code generators. UI lets you create a serious dBASE programmer had to take whatever code a generator produced and modify it to their needs. With UI, the developer can generate exactly the dBASE code wanted.

UI (User Interface) has two main functions: the first is a powerful form editor to create sophisticated screens and forms in a matter of minutes. The editor is completely menu-driven. It works on the "point-and-shoot" principle—just put the cursor where you want and tell UI what to put there.

UI's other, more important, main function is generating code for the forms.

you've designed. Once you have a form the way you want it, you call up the "Generate" menu and tell UI which template you want to generate the code with. That's the key—each template tells UI to produce a different kind of dBASE program.

It is through these templates that you can program the way UI generates source code. You can use the templates that come with UI "as is" (there are about 25 of them), completely rewrite them, or write your own. So you don't lose control of design, like you do with other generators. You just let UI do the tedious work.

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## dBASE AT THE SPEED OF C

dBx Translates dBASE Applications to C

You dBASE™ programmers know what as expensive and readable language dBASE is. It's a very comfortable development environment. But the price is delivered performance. Even compiled dBASE doesn't offer the speed that some users require these days. The kind of speed offered by software written in the C language. The answer is dBx™. dBx translates dBASE to C. It offers you a major competitive advantage over the rest dBASE programmer. Keep writing in dBASE. Take every application all the way to completion. Then use dBx to translate them top to bottom to C.

Other advantages: C is portable, even to other operating systems like UNIX, Xenix™, or the Macintosh or Amiga. dBx gives your applications a passport to places dBASE cannot go.

Has its own file manager for single user, but links to major C file managers—c-tree and dBC—for compatibility with dBASE files or multi-user support. We have everything you'll need, including good advice. Let PC Brand.

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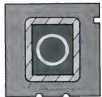
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■ MITT JONES

# PC ADVISOR



*Help in fully exploring the resources of your computer through on-line services and bulletin boards, and in gaining VGA compatibility for your monitor.*

## EXERCISING A MODEM

I recently got a good deal on a 1,200-bit-per-second modem and communications software. The problem is that now that I have it, I really don't know what I can do with it. Any suggestions?

Valerie Gaglione  
White Plains, New York

*You've stumbled upon a resource that will broaden the power of your computer considerably. Whether you treat your computer as a powerful toy or a valuable tool, you'll get a lot more out of it by exploring the options available to you with a modem.*

First, you can access scores of bulletin boards across the nation, usually free (aside from any long-distance phone charges). The more-popular bulletin boards give you access to megabytes of software that you can download to your system and try out.

Some of the software is freeware or public domain, which means you won't have to pay the developer a cent. But, many of the best programs available from bulletin boards are shareware—you try out the software, and if you intend to keep using it, you're obligated to pay the developer a nominal fee, which usually ranges from \$5 to \$50.

PC Magazine operates its own bulletin board—the Interactive Reader Service. The IRS is free of charge and operates 24 hours a day. In addition to giving you access to the programs and utilities printed in PC Magazine, the IRS offers indexes to the magazine, a list of other worthwhile bulletin boards nationwide, and a list of

PC user groups. To try out the IRS, set your modem to 8 data bits, no parity, and 1 stop bit. The East Coast number is (212) 696-0360. The West Coast number is (415) 598-9100.

Another class of resource that you can now access encompasses on-line services, such as CompuServe (Columbus, Ohio; (800) 848-8199) and The Source (Source Telecomputing Corp., McLean, Va.; (800) 336-3366). These services carry usage fees, and charges can run up fast. But the information and conveniences provided make them well worth their cost.

For instance, you can shop for a wide variety of goods on-line, book your own airline flights, access databases of stock performances, browse through reference works, or chat on-line with other subscribers. You can also access special interest groups (SIGs), which allow users with common interests to share information.

Whereas CompuServe and The Source

offer a bit of everything, other services specialize in extensive databases meant for serious research. For a more complete look at on-line services geared toward business and home use, dig up your May 12, 1987, copy of PC Magazine, in which we look at the features 12 on-line services offer ("On-line Databases: Dialing for Data").

## VGA MONITORS

I now use a NEC MultiSync and EGA board with my XT. I want to upgrade to a VGA card, but I've heard conflicting reports about the MultiSync's ability to run VGA. Will I be able to use my trusty MultiSync? If not, which monitor should I purchase? Also, which VGA boards do you recommend?

Marcus Maslany  
Toronto, Ontario  
Canada

As you may have noticed in the table of contents, we review five VGA boards for XTs, ATs, and compatibles in this issue ("VGA Compatibles: Gaining on the New Standard"). Turn to that article for guidance on choosing a VGA adapter.

On the subject of your MultiSync, the answer is a qualified yes. The MultiSync can display VGA graphics once you buy NEC's IBM PS/2 Cable Adapter (\$19.95; NEC Home Electronics, Wood Dale, Ill.; (800) 632-7875).

Still, you'll notice some inconsistencies in the vertical size of the display. With past display standards—MDA, CGA, and EGA, for example—the MultiSync altered

■ Whereas CompuServe and The Source offer a bit of everything, other services specialize in extensive databases meant for serious research.



## ■ PC ADVISOR

the vertical screen size as a function of changes in the horizontal scan rate. With VGA adapters, however, the horizontal scan rate is constant.

IBM designed into the VGA standard an easy way for monitors to determine the correct vertical size of the display: different combinations of the vertical and horizontal sync signal polarities indicate a different number of scan lines. The automatic vertical sizing in the IBM analog monitors keys on these signals and adjusts the vertical size of the screen accordingly.

Because your MultiSync, like other multiscanning monitors on the market prior to the introduction of the PS/2s, does not include this automatic-vertical-sizing circuitry, you'll have to adjust the vertical size of your screen manually when the VGA changes display modes.

Of course, manually adjusting the size of your screen isn't really a traumatic experience, but you've got other options if

you'd rather not put up with an erratic display.

*The \$999 Zenith ZCM-1490 (see First Looks, page 48, PC Magazine, Novem-*

## ■ The MultiSync can display VGA graphics once you buy NEC's IBM PS/2 Cable Adapter.

ber 10, 1987) boasts the sharpest, deepest, and most glare-free display I've seen to date, and it does sport the necessary circuitry to keep the vertical screen size constant. The ZCM-1490 (Zenith Data Systems, Glenview, Ill.; (800) 842-9000) is also analog only, so you'll want to hang on

to your MultiSync if you expect to need a digital monitor in the future.

Princeton Graphic Systems was the first manufacturer to ship a digital/analog multiscanning monitor that incorporates the automatic-vertical-sizing circuits. And priced at \$795, this versatile monitor goes for a good deal less than the Zenith. Refer to First Looks, page 33, December 22, 1987, for a closer look at the Ultrasync (\$795; Princeton, N.J.; (800) 221-1490).

NEC has announced a successor to the MultiSync, the MultiSync II, which also adds automatic vertical sizing. That monitor is due on the market by the time this issue goes to press, and it should offer roughly the same display quality as the MultiSync.

### ASK THE ADVISOR

Send your questions to the PC Advisor, PC Magazine, One Park Avenue, New York, NY 10016.

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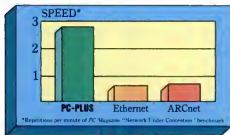
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# FIRST LOOKS

## Two More Ways to Bring PCs into the 80386 Era

### PC HANDS ON

BY WINN L. ROSCH

The 80386 remains unchallenged as the best DOS processor on the market, making PCs equipped with lesser chips seem as up-to-date as pet rocks. Although installing a turbo board can keep your PC more timely, until now 80386-equipped products have required an AT to build upon. This twosome—the

\$995 Inboard 386/PC, from Intel Corp., and the \$1,195 Quad386XT, from Quadram Corp.—finally bring that 32-bit power to 8088-based computers.

The two boards are similar in both concept and design. Both are replacement-style turbo boards. You pull out the 8088 microprocessor in your PC or XT and pop a special adapter cable into its vacant socket. The cable lets the board take over for

the 8088, while the card also connects through the standard PC bus in a single full-length expansion slot for power and other logic connections.

Both boards are designed for PCs andXTs with specific support for certain clones. They will not work with 8086-based compatibles like the AT&T 6300 and Compaq Deskpro (the Compaq Portable and Portable Plus are OK).

Although both manufacturer-

ers recommend boosting the power supply of your PC to more than 125 watts, in testing, a standard PC ran each product as well as an admittedly low-power hard disk card (a 5- to 8-watt Western Digital FileCard 10). If you don't have one, you'll want to add some kind of hard disk to take advantage of turbo performance.

Superficially, the boards look very much the same. Both

(continues on page 35)

## Microsoft C 5.0 Comes with a Quick Bonus, Adds 70 Functions

### PC HANDS ON

BY STEPHEN RANDY DAVIS

Several years ago, no one could have predicted with any certainty that mass-marketing techniques would be applied to something as technically specialized as the C language. Yet in early 1988, Microsoft Corp. and Borland International are involved in a head-to-head competition for the affections of thousands of C programmers.

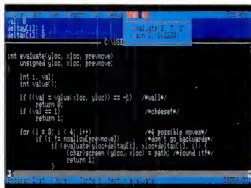
The newest offering from Microsoft is something of a two-for-one offer: Microsoft C 5.0 combines an upgrade to its well-established C compiler with Microsoft Quick C, a new, smaller program that's more in the mold of Borland's Turbo C. You can buy Quick C separate-

ly, but if you do, Microsoft is hoping that you'll one day step up to C 5.0 and is offering a dis-

count on the extra purchase.

C 5.0 is much like C 4.0 in

(continues on page 36)



The Microsoft Quick C Programming Environment debugger allows breakpoints (the line that is highlighted in yellow), trace variables (in the blue area on top), and a trace back (drop-down window).

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# DataPerfect Builds LAN-Ready, Easy-to-Program DBMS from WordPerfect Roots

## PC HANDS ON

BY GENE SMILGIEWICZ

In its quest for a "more perfect" world, WordPerfect Corp. has introduced *DataPerfect*, an intriguing database manager. Striving to claim the middle ground between simple file managers and complex database management systems, *DataPerfect* provides powerful data management capabilities that

play controls, and field-oriented help messages. The list of options for field formats and formulas, panel linkage and windowing, reporting, and data entry control is comprehensive and should handle most situations.

*DataPerfect* does not rely upon procedures written in a programming language to handle data entry, lookups, and report generation. Instead, you rely upon the myriad menu-

multiple related panels simultaneously on-screen is built in. *DataPerfect* also provides sophisticated searching procedures and data validation techniques.

Network record and file locking, a real chore to program in many DBMSs, are handled automatically. If a record on one user's screen is modified by another user on the network, the changes are reflected immediately as *DataPerfect* displays a message indicating the action of the other user.

*DataPerfect's* reporting capabilities are considerable. Report formats are flexible and easy to define. Multiple formats, such as columnar reports, form letters, and data interchange reports, may be assigned to a panel (in addition to the quick report format generated automatically upon definition of a panel). Reports may contain data from any panel in a database, as well as several varieties of headers and footers and report variables to store calculated values. Each report may specify any one of several index files associated with a panel to govern output sequence.

*DataPerfect* requires only 192K of available RAM and may be run easily from a single floppy disk. Data and index file capacities should fulfill the requirements of most applications suitable for PCs. On a PC AT with a hard disk drive, the program responds quickly to commands, while most application procedures are executed extremely quickly, if not instantaneously.

Considering the ease and speed of *DataPerfect's* "programless" application development method, there isn't much to criticize. Aside from some cumbersome definition techniques, there are only a few aspects of the program that should be improved.

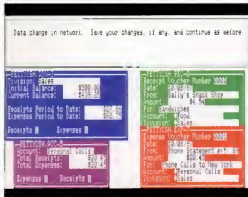
Due to the ubiquitous menu/help region atop the screen, panels are restricted to the bot-

tom 17 rows of the screen, limiting the number of fields that may be included in any one data file. Only one panel may be defined per data file; alternate views of the data within a file are only possible via one-line lookup lists. It would be nice if designers could exercise more control over the appearance of panels.

Users may easily switch from operating an application to modifying it. Though a boon to development, this unimpeded access to design features may lead to applications being disrupted by unwitting users. Runtime modules will soon be available, however.

All in all, *DataPerfect* is a solid performer that should appeal to a wide range of users.

Any user should appreciate the ease and speed with which applications can be developed, and the program offers a high degree of functionality while occupying little memory. *DataPerfect's* network readiness is also a real plus.



WordPerfect's *DataPerfect* (\$95) advises the user of any changes to the current record by someone else who is on the network. Note how the panels are related through doorways (the field marked by diamond shapes).

are accessible without programming.

*DataPerfect* ties in closely with *WordPerfect*. It shares many screen and keyboard commands for editing and session control. When run in conjunction with *WordPerfect Library's* shell, *DataPerfect's* functionality is expanded to include cut-and-paste and macro capabilities. However, the program is hardly diminished when run as a standalone system.

*DataPerfect* databases consist of from 1 to 80 data files termed "panels." When setting up a new panel, you specify one or more indexing schemes, links to other panels via "doors" and "doorways," report formats, data entry and dis-

played control and definition techniques provided. These are not always intuitive but are clearly documented in the manual and in a good tutorial. They should be equally cryptic to both experienced computer users and novices, though much less taxing to learn than a language. Familiarity with *WordPerfect's* function keys will shorten the learning curve.

Complex applications may be developed quickly with a consistent "look and feel." Developers will appreciate the features available without having to write extra program code. Browsing through data files is as easy as pressing the Up cursor. Color-coded panels is a snap. The capability to display

## PC FACT FILE

### DataPerfect

WordPerfect Corp.  
288 W. Center St.  
Orem, UT 84057  
(801) 225-5000

List Price: \$595

Requires: 192K RAM, one disk drive, DOS 2.1 or later (DOS 3.0 or later on network systems). *WordPerfect Library* required for some functions.

In Short: A "programless" database system offering a wide range of data management and reporting options. Outstanding features include multifile relation capabilities, network support, and the "look and feel" of other WP Corp. programs. Not copy protected.

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## 80386 Boards

(continued from page 33)

have the square black 80386 chip almost midway on the card with a vacant coprocessor socket nearby. The vital connecting cable attaches at the top, and 1MB of 32-bit bus memory adorns the far end.

Both boards come standard with three dozen 120-nanosecond, 256-kilobit dynamic RAM chips. Connectors allow further memory expansion via daughtercards—2MB more for the Intel, up to 8 more megabytes for the Quadram.

Many design details are different, however. While the Intel coprocessor socket permits only the 80387, the Quadram also hosts the slower 80287 or the Weitek 1167 for faster number crunching. The Intel cable is shorter, but its connectors are oriented more favorably than those of the Quadram.

The boards also adapt differently to the memory already in your system. The Intel demands that all expansion beyond 256K be yanked out while the host's DIP switches are set for 640K. It maps its own memory over the full 640K DOS memory area, reserves 128K for phantom ROM, and delivers 256K of extended memory from its standard megabyte.

Quadram requires that you install as much normal 8-bit memory as you want the

Quad386XT to replace with 32-bit, so if you want 640K of fast RAM, you've got to have the same amount of standard RAM available. Try to fool it by altering the host system's DIP switches, and the system crashes with no explanation for the error.

All but 128K of this memory appears as extended, although an amount equal to the 8-bit RAM your system has installed works as conventional memory. Quadram allows the mapping of BIOS routines into 32-bit RAM and also supplies a driver to speed up video routines and implement EMS.

Besides diagnostics and speed-changing software, Intel supplies an EMS driver and a disk-caching program. In addition to its drivers, Quadram also includes a performance test, diagnostics, a RAMdisk, and a print spooler with the Quad386XT.

As with most replacement-turbo boards, both members of this twosome are well-behaved. Video updates are snappy rather than jerky, and disk access suffers not at all.

In fact, Intel's BIOS enhancements and disk cache help the rest of your aging PC system keep up with the zippy new microprocessor. Quadram's treatment of these matters is not quite as successful.

While the performance of the two products falls in the



## FACT FILE

## Inboard 386/PC

Intel Corp.  
Personal Computer  
Enhancement Operation  
5200 NE Elam Young Pkwy.  
Hillsboro, OR 97124  
(503) 629-7354  
List Price: \$995 (with 1MB RAM).

Requires: PC, XT, Compaq Portable or Portable Plus, or Tandy 1200.

In Short: A replacement-style 80386-based turbo board for many 8088-based computers. Includes 1MB of 32-bit RAM standard, expandable to 2MB.

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## Quad386XT

Quadram Corp.  
One Quad Way  
Norcross, GA 30093  
(404) 923-6666  
List Price: \$1,195; 2MB daughtercard, \$775.

Requires: 8088-based PC or compatible.

In Short: A replacement-style 80386-based turbo board that enhances ordinary PCs and XT's with 32-bit performance. Includes 1MB standard, up to 8 more MB of fast RAM, and support for 80287, 80387, and Weitek 1167 numeric coprocessors.

CIRCLE 427 ON READER SERVICE CARD

same ballpark, the Quadram earns a slight edge on CPU speed. Intel's board handles memory and system integration better. Burdened by memory wait states, the performances of both rate below that of a 16-MHz Compaq Deskpro but about 70 percent better than that of an 8-MHz AT.

Of course, performance is not the only reason—or even the best one—to buy one of these products. The features an 80386 brings to your system, such as its superior memory handling and inherent multi-

tasking abilities, are the biggest blessing. (Intel is bundling 386-to-the-Max, a utility that lets you run memory-resident programs out of RAM above 640K, with the Inboard 386/PC.)

Both of these turbo boards deliver. Choose the Quadram board for its massive memory abilities and choice of numeric coprocessors. The Intel wins for its superior integration and greater on-screen snap—over-

all, a more satisfying and affordable product. ☐



## Benchmark Tests: Quadram Quad386XT and Intel Inboard/386PC vs. Compaq Deskpro 386

We compared these two 386 upgrades for PCs to the most popular 386-based PC around, Compaq's Deskpro 386, since it runs a 16-MHz 386 processor. The two boards don't beat the Compaq, but they turn in respectable performances compared with that of the \$6,000-plus computer.

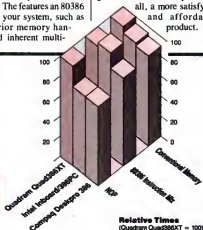
Performance Times  
(Times given in seconds)

	NOP	80386 Instruction Mix	Conventional Memory
Quadram Quad386XT	2.14	4.56	0.85
Intel Inboard/386PC	1.70	4.73	0.90
Compaq Deskpro 386	1.70	4.01	0.77

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 528K loop.

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 in-

struction code. These instructions are a subset of the Intel processor instruction set. The 80386 instruction mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 8088 versions of the benchmark test they remain multiple instructions.



The Conventional Memory benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 18,384 random records are read into and written from this memory. The result is the average of the read and write times.



## Microsoft C 5.0

(continued from page 33)

operation, sporting the same command line interface. Microsoft claims, however, improved code generation, faster compilation speed (see benchmark tests for performance results), and support for ROM programs. In addition, C 5.0 adds increased support of the ANSI C draft standard, including full-function prototyping, Const and Volatile variable type specifiers, the addition of the Enum data type, and the new preprocessor operators # and ##. A Setup program has also been added to alleviate the burden of installing the sizable C 5.0 package.

Microsoft has improved the 5.0 RunTime Library as well, adding some 70 functions while modifying many of the existing functions to be more compatible with UNIX and the ANSI draft standard libraries. In addition, C 5.0 includes a separate graphics library of some 40 functions designed to perform such operations as setting video mode and color palette and drawing pie charts on CGA, EGA, and VGA adapters.

The biggest improvement to C 5.0, however, is not 5.0 at all, but rather Quick C, the separate compiler included almost as a bonus. Quick C combines the features of an editor, a debugger, and a compiler to form a

powerful Environment. Much like QuickBASIC and Borland's Turbo languages, with Quick C the programmer can call up a source file, edit it, compile it, and debug the resulting program, all without ever leaving Quick C.

The Quick C command interface is of the drop-down-window, point-and-shoot variety. Gone are the impossible-to-remember command line switches, replaced now by menus of options.

The Quick C editor is quite serviceable for program entry, accepting either WordStar-type keyboard or mouse commands. Integration with the Quick C compiler allows for automatic positioning of the cursor on compilation errors. Included are the Go to Next Error and Go to Previous Error commands for moving quickly among compiler errors. The Quick C debugger, accessible via a menu option, is a subset of the state-of-the-art CodeView debugger. Although Quick C lacks the more-advanced features, all of the basic operations such as Set Breakpoint and Set Watch Variable are present.

Interestingly, recompiling does not remove breakpoints, so that breakpoints set previously are still available once you return to debugging.

Microsoft guarantees complete compatibility between Quick C and C 5.0. Both com-

pililers share identical run-time libraries.

C 5.0 includes the newest release of the CodeView debugger. Also included are a host of "power-user" utilities, among them an overlay linker, a library manager, and a MAKE-type program maintenance utility.

So what's missing? The most obvious weakness is that the programming environment of Quick C supports only the medium-size memory model. To use any of the other memory models, you must exit the environment and use the command-line version, which supports small, medium, and large models. The Quick C environment does not allow quite as much control as I would have liked. Many user-controlled features must be set in the DOS environment before entering Quick C.

For its part, C 5.0 does not support in-line assembler, nor does it register pseudovariables. In addition, Interrupt-type functions are not allowed. Both of these limitations can be addressed by including assembly language modules together with C 5.0 modules at link time.

The Quick C and C 5.0 combination make a powerful duo. Deciding between them is tough: For \$450, you get everything. For \$99, you get Quick C without CodeView, and aside from some extra optimization that C 5.0 performs, the only important C 5.0 feature you'll



## FACT FILE

**Microsoft C 5.0**  
**Microsoft Quick C**  
**Microsoft Corp.**

16011 NE 36th Way

Redmond, WA 98073-9717

(800) 426-9400

(206) 882-8080

**List Price:** \$450; upgrade from Version 4.0, \$75; upgrade from 3.0 and earlier, \$150; Quick C alone, \$99; upgrade from Quick C to C 5.0, \$225.

**Requires:** 385K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.

**In Short:** Microsoft has bundled its new Quick C compiler with an upgrade to C 5.0. By itself, Quick C lacks CodeView and some optimization provided by C 5.0. Both are excellent programming tools. Not copy protected.

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lack is support for huge models.

Quick C makes a great buy by itself, especially if you already have CodeView. At \$99, it makes its big brother look awfully expensive.



## Benchmark Tests: Microsoft C 5.0 vs. Microsoft C 4.0 and Borland's Turbo C 1.0

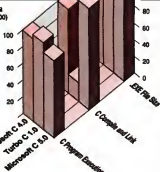
We had to compile the Microsoft C 5.0 benchmark program in a medium-size model since the program created a model larger than 54K; both Microsoft C 4.0 and Turbo C 1.0 were tested with small models. The results were mixed: C 5.0 created larger .EXE files, but those files ran much faster.

### Performance Times

	C Program Execution (minutes)	C Compile and Link (seconds)	.EXE File Size (K)
Microsoft C 4.0	266	357	73
Turbo C 1.0	279	60	81
Microsoft C 5.0	247	432	87

The C Program Execution benchmark test times the execution of a series of integer, floating-point, characterizing, control statement, and file operations. The cumulative execution time in minutes is presented to give a

simple comparison of CPU-bound performance. These tests are run on an 8-MHz IBM PC AT under DOS 3.2; file operations are performed on a RAMdisk with BUFFERS set at 5.



The C Compile and Link benchmark test measures compile and link operations, including linking all run-time support. DPH reports the size of the resulting .EXE file, and the test shows the elapsed time for the compile and link operations performed on a 5,530-line program.



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## N.e.w.s

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PC Paintbrush for Windows is available immediately from ZSoft. PC Paintbrush+ for Windows is scheduled for release in August.

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ZSoft Corporation can be reached by phone at (408) 800-1000, or by mail at 450 Franklin Rd., Suite 100, Marietta, Georgia 30067.

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# Z-SOFT

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# The Diconix Line Grows Wider, Stays Quiet

**PC HANDS ON**

BY JONATHAN MATZKIN

If more is better, then the Diconix 300w should be a great printer, since it's a larger, more versatile version of the tiny Diconix Model 150, the printer of choice for hard copy on the go.

The \$450 Model 150 puts out decent-looking ink jet output, runs on batteries, and fits neatly into many laptop computer cases. Rarely has a computer peripheral fit so well into its intended niche.

The same can't be said for Diconix's \$750 Model 300w. It's a highly competent printer, with a solid array of features, but it doesn't excel in the office nearly to the degree that its little brother shines in the field.

Most noticeable among its shortcomings is print quality. The 300w prints acceptable-looking characters on plain paper, unlike some other ink jets, but the print quality doesn't compare to dot matrix output from many machines costing significantly less.

Draft-mode characters aren't dark enough, and the constituent dots of each character are clearly visible.

The machine's quality font is considerably darker and

smoother than the draft output, and the typeface is fairly attractive. The ink jet print, however, has a ragged, feathered look that limits its usefulness for important correspondence. In all fairness, the 300w probably does much better with treated paper designed for ink jet printing, and in any case the output is never less than quite readable.

Its print speed is a second strike against the Model 300w.

Our benchmark tests clocked it at a little over 130 characters per second in draft mode, which is respectable but by no means fast. In quality mode, output drops to a stately 34 cps, which is downright slow.

There are, however, a number of reasons why the Diconix 300w may meet the needs of some users. For one thing, at under 62 decibels it is one of the quietest printers I have ever test-

ed. That makes it attractive in locations such as libraries, hospitals, and classrooms.

And it handles paper very well. Loading is fast and easy; the printer automatically rolls the first sheet into top-of-form position. Paper parking eliminates the need to remove continuous forms in order to load cut sheets.

It's also light enough to pick up and carry around easily. While it doesn't run on batteries like its diminutive sibling, the Model 150, the 300w is definitely "transportable."

To these strengths add a wider selection of fonts than is usually found on ink jet printers.

The Diconix 300w is an interesting attempt to extend the company's success from the laptop to the desktop. This printer has some distinct advantages of size and sound level that suit it well to some environments. But its print quality and speed limitations—in conjunction with its price—make it a questionable candidate for workhorse use in general office situations.

List Price: Diconix 300w, \$750.  
Diconix Inc., a Kodak Co., 3100 Research Blvd., Dayton, OH 45420; (513) 259-3100.

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## Diconix 300w



Our constitution is in operation; everything is to promise that it will; but in this world nothing certain but death and tax. Draft Bold Underline Com Elite Bold Underline Com Proportional Bold Underline

Type: Ink jet  
Carriage width: 15 in.  
Price: \$749

SPEED (cps):  
Rated—310  
Default—131

TYPE PITCHES: 10, 12, 15, 17

SOUND LEVEL (decibels):  
Rated: 48  
Tested: <62

FEATURES:  
Printing: Bold, double-strike, correspondence quality, underlining, sub/superscript  
Formatting: Proportional spacing, horizontal tabs, vertical tabs, variable form length

COMPATIBILITY:  
IBM character set: Low and high  
Graphics: Epson FX, Epson MX-80, IBM Proprietary  
Text: Epson FX, IBM Proprietary

# On-Call: Reliable TSR Manager

**PC HANDS ON**

BY EDWARD MENDELSON

On-Call is the TSR manager that works. This \$69.95 utility from Forest Hill Software gives you quick access to all the resident

programs in memory and make available for use. The last pop-up you used gets swapped back to disk. If you use TSRs like disk caches or keyboard enhancers that should be available at all times, you simply load them separately and use On-Call for other programs that you don't need continually.

Unlike RAM Lord (see First Looks, page 46, PC Magazine, December 22, 1987), On-Call makes no attempt to perform fancy tricks with expanded memory, and so it's slower than that TSR manager. But it's also

safer: I couldn't find any combination of TSRs that made it lock up. If you ask On-Call to handle a cantankerous TSR like SideKick, it swaps the offending program to disk at hazardous moments. It's inconvenient to have to reselect SideKick from On-Call's menu, but it's a lot less inconvenient than losing a day's work in a lockup.

On-Call uses 40K RAM plus the memory needed for the largest TSR it manages. The design is conservative, but with any utility that manages RAM, conservative management is the best management of all.

**PC FACT FILE**

**On-Call**  
Forest Hill Software Inc.  
6689 Orchard Lake Rd.  
West Bloomfield, MI 48322  
(800) 443-4134  
(313) 489-0912  
List Price: \$69.95 (\$54.95 when ordered directly from the publisher).  
Requires: 256K RAM, one disk drive (hard disk recommended), DOS 2.0 or later.  
In Short: A pop-up manager that works conservatively and reliably. Not copy protected.

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428-0086



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doesn't mean you have to  
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upside down!

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and your computer go off in  
other directions... together!

When you swear at your printer...  
does that help you remember how  
to get it into compressed mode?

Duet's pop-up menu allows you to select  
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quality or draft. You can change spacing,  
choose a font or easily command what-  
ever else your printer has to offer. You  
can even advance your paper a page or a  
line at a time without having to approach  
your hardware. On laser printers you  
can choose between landscape and por-  
trait modes, select paper tray and lots  
more. And you'll never have to memorize  
escape sequences to do it. Duet can make  
your word processor, spreadsheet or  
database report generator do things with  
the printer it never knew was possible.

When you need to stack up  
a bunch of files to be printed,  
do you ever feel like you're just  
groping in the dark?

With Duet, you can see a list of what's  
waiting to be printed, any time you want.  
You even have the ability to go in and  
shuffle things around, cancel files and  
individually configure print jobs for  
sideways or normal print.

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Anyone who's been around printers  
for a while knows the feeling of groping  
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flies in all directions and the  
print head bores a hole in your  
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saves print queues to disk. When  
you bring the power up again, or  
clear the confetti out of your  
printer, you'll be able to restart  
wherever you left off... or even  
back up a page or two if necessary.

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forced out of your own office  
because someone came to  
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CIRCLE 213 ON READER SERVICE CARD



# Datamedia Colorscan/2 Unites DEC and PC Power in One Box

**PC HANDS ON**

BY FRANK J. DERFLER, JR.

In organizations that wield a lot of computing power, it isn't unusual to see people with several PCs and/or terminals on their desks. It also isn't unusual to see someone typing data into a PC as he reads it off a terminal screen. Now Datamedia Corp. has come up with a better way to integrate these functions. It has produced a device called the Colorscan/2, which combines a full-featured DEC VT-240 terminal, a fast PC with EGA, and a LANstation in a box that's barely big enough to hold up a NEC MultiSync monitor.

The Colorscan/2 system uses an 8-bit NEC V30 processor operating at 8 MHz. Our tests showed some functions running as fast on this system as they do on the 8-MHz IBM PC AT. The apparent operating speed of many applications is enhanced by Datamedia's fast proprietary EGA chip set with its own 256K dynamic RAM.

Datamedia's designers used both advanced circuit board design and unique storage techniques to pack so much into a 10-by-15-by 2½-inch cabinet. The Colorscan/2 uses a small number of high-density integrated circuits and surface-mounting assembly techniques. You can add several storage and memory options that don't in-



In its base configuration, the Colorscan/2 has two free PC expansion slots.

crease the physical size of the system. One of these options allows up to 2MB of internal battery-backed storage on a RAMdisk; another is a credit-card-size nonvolatile storage device called a CARDFile. The system will boot MS-DOS from the CARDFile or the RAMdisk. A small auxiliary cabinet houses a 3½-inch floppy disk formatted at 1.44MB and a 20MB hard disk drive.

The Colorscan/2 has two PC-type expansion slots, two serial ports, and a parallel printer port. The expansion slots aren't used for the video or I/O, so they are free for network interface cards and/or interfaces connecting to IBM mainframes. One of the serial ports is rated at 38.4 kilobits per second (a speed supported by the new DEC terminals).

The CARDFile used in the Colorscan/2 is based by Epson. The assembly for reading and writing the card is smaller than a 3½-inch floppy disk drive. The card itself is the size of a plastic credit card (but twice as thick) and holds up to 128K of data. The card contains a small lithium battery and a write-protect switch.

As a PC, the Colorscan/2 uses a customized version of MS-DOS and does a fine job running PC applications. As a LANstation, the Colorscan/2 accepts network interface cards for any network cabling and access scheme. It isn't likely that remote-boot PROMs will work with the complex Colorscan memory management system, so the network operating system will have to boot from one of the local storage alternatives.

As a terminal, the Colorscan/2 provides 132-character text in 25 lines or 132 characters by 35 lines in alphanumeric format. In either terminal or PC mode, the system displays 16 colors simultaneously from a palette of 4,096 colors at resolutions varying up to 800 by 480 pixels.

Operation of the Colorscan/2 is very smooth. You toggle between two host connections and the MS-DOS session with a keystroke. Special programs in the Colorscan/2's ROM let you capture screens or

entire files for transfer over to other sessions. You can start a file transfer between the workstation and a host in one session, toggle to the DOS session and write a memo, and the transfer will continue.

The overall concept and execution of the Colorscan/2's design is so well done that its few rough edges grate. If you install the external disk drives, the beautiful physical appeal of the system is marred by a nest of AC power cables winding in round-robin fashion between monitor, workstation, and disk drives. The suspense involved in plugging the system together is intensified by warnings that an improper sequence of switch closures might harm at least one power supply.

The Colorscan/2 is an excellent solution to desktop clutter for anyone needing access to any combination of PC, LAN-based, and host-based applications. Overall, it is a well-designed and effective answer to multisystem connectivity requirements.



## FACT FILE

### Colorscan/2

Datamedia Corp.

11 Trafalgar Sq.  
Nashua, NH 03063  
(603) 886-1570

**List Price:** Colorscan/2, with IBM keyboard, Variable Frequency Color Display, VT-240 emulator, \$2,000; RAM File (installs in main unit), includes 2MB low-power CMOS RAM with battery backup, \$750; CARDFile (installs in main unit), includes 64K read/write, \$150; DISKFile (a separate cabinet), includes 1.44MB floppy disk drive and controller, \$550 (a separate cabinet); 20MB hard disk upgrade (installs in DISK-File cabinet), \$445.

**In Short:** Combination of a PC clone and VT-240 workstation in one small cabinet. Offers unique optional credit-card-size storage and optional 2MB battery-powered RAM.

CIRCLE 491 ON READER SERVICE CARD



The Colorscan/2 system requires an optional external disk drive (left) if you want to use floppy disks. Datamedia sells the system with a NEC MultiSync, the Colorscan/2 runs a proprietary EGA adapter with additional terminal emulation video modes.



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- Copyparts
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# Core Revs Up 29-ms. Drive for Model 50

## PC HANDS ON

BY MITT JONES

If nothing else, IBM's insistence on shipping the Model 50 with a 20MB, 80-millisecond hard disk drive has created some innovative third-party disk designs (see review of the Rodime Double Play, First Looks, PC Magazine, December 8, 1987).

The latest comes from Core International in the form of the ATplus43EPS—a high-performance, 43MB external disk drive with external power supply. A circuit board with three edge connectors installs between the stock drive and its mounting sled. The board splits the signals from the Model 50's disk controller, allowing both the stock drive and the Core external drive to run off the Model 50 disk controller.

Running both disks in one system is a bit like watching a gazelle bound past a garden slug. PC Labs benchmark tests clocked the Core drive at 29 ms., compared with the stock



The Core ATplus43EPS taps the IBM disk controller via a circuit board that attaches to the Model 50 stock disk (right).

drive's 81-ms. performance.

But you don't lose anything by keeping the Model 50 disk around, as long as you put some thought behind configuring the drives. For instance, the Core partitioning software lets you logically link the slow stock drive to the ATplus to form one 63MB partition (minus the space required for a small DOS boot partition). But taking advantage of this nifty trick will leave you with little control over which of your files end up on the faster physical drive.

Despite its innovative design, the ATplus we evaluated

still requires one of the 50's four precious slots: a ribbon cable leads from the Core circuit board to a blank card that plugs into the Micro Channel architecture only for support. The external drive cable connects to this card.

The Core drive performed flawlessly during our tests. However, the Model 50 hard-disk-access indicator lit up along with the Core access light during each access to the Core drive. Though it is not a major problem, this oddity could

create confusion at times.

If you're looking for a fast, dependable disk for the Model 50, you can't go wrong with the \$1,412 ATplus. Core will soon be shipping the Optima, a similar disk for the Model 50, at a suggested retail of \$1,148. Instead of the 50,000-hour MTBF (mean time between failures) and 3-year warranty of the AT-plus, the Optima will carry a 35,000-hour MTBF rating and a 2-year warranty.



## FACT FILE

### Core ATplus43EPS

Core International  
7171 N. Federal Hwy.  
Boca Raton, FL 33431  
(305) 997-6055

List Price: \$1,412

Requires: IBM PS/2 Model 50.

In Short: A high-performance external disk drive for the IBM PS/2 Model 50.

CIRCLE 432 ON READER SERVICE CARD

# An Easier Way to Master AutoCAD

## PC HANDS ON

BY GUS VENDITTO

The multitude of books is making us ignorant. —Voltaire

The 18th-century Frenchman Voltaire didn't have the prescience of a Jules Verne, but he wouldn't have been surprised by the glut of computer literature in 1988. The average PC application comes with a 400-page manual that nobody has time to read, but that's just the beginning. There are books to help you get started, guides that will take you inside the program, and finally, the advanced user guide. It's enough to make Gutenberg weep. There are times when less is more.

AutoCAD became a standard partly because its many features are so well documented. Yet the

manual can quickly overwhelm a novice, unless the novice has days on end to devote to the school of hard learning.

That may be how you and I did it, but there is a better way for the next generation. *Applying AutoCAD: A Step-by-Step Approach*, by Terry Wohlers, is a hand-holding, streamlined approach to the basics of AutoCAD. Versions 2.5x and 2.6x.

The book walks you through the execution of a command, helping you sort out the many options. This is the real key to its value: where the AutoCAD menu piles up the option keywords, *Applying AutoCAD* picks out the most important choices to get your work started and then slides up to the refinements after you've got a drawing under control.

The chapters conclude with practice sessions that aren't

really necessary since the book's format involves constant hands-on work. It was written for individual or group lessons (an instructor's version is available).

You may take exception to the book's use of the Socratic method ("Enter ZOOM All. What happened to your text? Place more text on your screen. Does it appear on your screen?"). Instructors should answer questions, not generate them.

As if to reward you for your efforts, scattered throughout the book are short stories about unusual AutoCAD applications, such as the police department that uses on-screen maps to deploy patrol cars. It's entertaining, but not required reading.

This is no power designer's handbook. Only 23 out of 450 pages are devoted to LISP,



## FACT FILE

### Applying AutoCAD: A Step-by-Step Approach

By Terry Wohlers  
Glencoe Publishing Co.  
809 W. Detweiler Dr.  
Peoria, IL 61615  
(309) 691-4454

ISBN: 0-02-677080-6

List Price: \$26

In Short: An excellent primer for AutoCAD that walks the novice through basic steps.

CIRCLE 434 ON READER SERVICE CARD

which is covered in chapters that have titles like "Easing into AutoLISP."

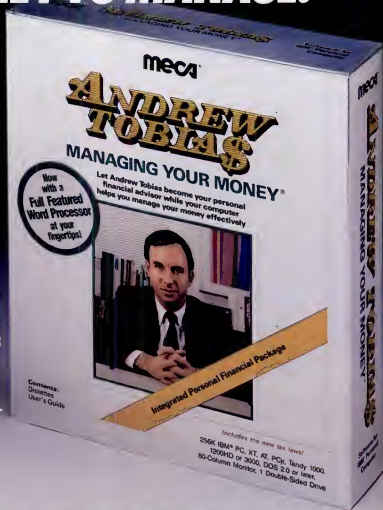
Considering the \$2,850 cost of AutoCAD and the labor cost of learning to use it, *Applying AutoCAD* could easily be considered a necessary companion to a new copy of AutoCAD.



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PC Magazine, 1987

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## NEW ON THE MARKET

**Internal AdaptaMODEM Increases Laptop Modem Transmission Rate to 2,400 bps**

Product R&D Corp. says that its AdaptaModem Model M24/COMMS is the first 2,400-bit-per-second internal modem for Toshiba laptops (models T1100 Plus, T1200, T3100, T3200, and T5100).

The \$499 Hayes compatible uses the computer's speaker.

Low-power CMOS circuits make the downsized (1 by 4½ by 5 inches), featherweight (.3 pounds) modem's power de-

mands all but inconsequential at .5 watts, claims Product R&D.

The AdaptaModem supplies an additional RS-232 I/O port.

**List Price:** AdaptaModem Model M24/COMMS, \$499. **Requires:** Toshiba laptop model T1100 Plus, T1200, T3100, T3200, or T5100. **Product R&D Corp.,** 1194 Pacific St., #201, San Luis Obispo, CA 93401; (805) 546-9713.

**CIRCLE 448 ON READER SERVICE CARD**

*Product R&D's AdaptaModem Model M24/COMMS (\$499) has a switch that shifts activity between a serial port and the RS-232 port.*

**CalComp Plotter Uses Coprocessor to Speed A-Size to D-Size Output**

The \$4,895 CalComp 1023 Pen Plotter plots on paper or film for A- to D-size output. It can use up to eight pens of various kinds—liquid ballpoint, fiber and plastic tip, and disposable or refillable liquid ink. Optical

sensors determine which type of pens are installed, and the machine adjusts the pressure and speed accordingly.

**CalComp** claims that the 1023 speeds along at 30 inches per second on axis and at 42 ips diagonally. Plotting accuracy is within .1 percent.

Plotting efficiency is improved by CalComp's Plot



*The \$4,895 CalComp 1023 Pen Plotter handles A- to D-size media and uses a rotating turret.*

Manager firmware, which uses two Motorola 68000 chips to minimize unnecessary pen motion, the company says.

The 1023 also lets you download your entire plot file to an optional 1- or 2MB expansion cartridge, freeing the computer while the plotter plots the job.

Other features on the 1023 include a keypad and 32-character LCD, memory for four parameter-setups, a grit drum,

aluminum construction, built-in diagnostics, and a safety cover.

The 1023 works with PCs and PS/2s, connecting with an RS-232.

**List Price:** CalComp 1023 Pen Plotter, \$4,895. **Requires:** RS-232 parallel port. **CalComp,** 2411 W. La Palma Ave., Anaheim, CA 92801; (714) 821-2142.

**CIRCLE 446 ON READER SERVICE CARD**

**Tandon Consolidates 20-MHz Speed and Data Pac Portability in Its 80386 Machine**

**Tandon Corp.'s** \$9,999, 80386-based desktop PC runs at 20 MHz and includes a receptacle for Tandon's portable hard disk chamber, the Personal Data Pac.

The Tandon 386 comes with 2MB RAM on the motherboard. The 32-bit data bus can handle additional SIMMs (single in-line memory modules) to raise RAM by 8MB. Memory access is sped up by a 64K static-RAM cache. There is also a socket to accommodate an 80387 numeric coprocessor.

Mass storage is provided by a 112MB hard disk and Tandon's RLL (run length limited) controller, which furnishes a 128K disk cache. Also standard is a 1.2MB, 5¼-inch floppy disk drive. An optional 3½-inch disk drive will be offered by Tandon.

The optional Data Pac provides 30MB of additional mass storage. The Pac can be removed and transported for use on another machine with a receptacle, or it can be locked in a safe for data security. Tandon is

planning to release 20- and 40MB Data Pacs soon.

Tandon supplies eight expansion slots, parallel and serial ports, a 190-watt power supply, and a real-time clock. The manufacturer also supplies MS-DOS 3.3, Microsoft's GW-BASIC, and Microsoft Windows/386.

The price of the Tandon 386 does not include a monitor or video graphics adapter card.

**List Price:** Tandon 386, \$9,999. **Tandon Corp.,** 405 Science Dr., Moorpark, CA 93021; (805) 523-0340.

**CIRCLE 443 ON READER SERVICE CARD**



*The (\$9,999) Tandon 386 contains an Intel 80386 microprocessor running at 20 MHz, 2MB RAM, a 112MB hard disk with 27-millisecond access time, and a slot for Tandon's Personal Data Pac.*



by Michael W. Muchmore



The 4½-by-9-by-½-inch Numerikeys, from Genest Technologies, hooks up to the printer cable between the printer and PC and can work simultaneously with the printer.

### Numerikeys Allows PC, Laptop Users to Enter Numbers More Easily

Genest Technologies' 33-key minikeyboard is an add-on numeric keypad for laptop and desktop PCs. Numerikeys is designed to make spreadsheet work easier on cramped laptop keyboards.

The \$129 Numerikeys boasts separate keys for cursor control, math functions, and page movement functions. Number keys double as function

keys. The keypad connects to the parallel port through a pass-through plug that doesn't interfere with printing.

Numerikeys is portably lightweight and small in size (4½ by 9 by ½ inches), and its power consumption is negligible.

**List Price:** Numerikeys, \$129. Genest Technologies Inc., A Pursuit Subsidiary, 1331 E. Edinger Ave., Santa Ana, CA 92705; (800) 826-9641.

CIRCLE 444 ON READER SERVICE CARD

### Funk Software Adds a Worksheet Tool Set to Its 1-2-3 Add-In Lineup

Funk Software, which gave us the hugely popular *Sideways*, has introduced *The Worksheet Utilities*, a \$99.95 smorgasbord of productivity improvers.

The six utilities consist of a Formula Editor, Search and Replace, Print Settings, a File

Manager, AutoSave, and a Range Column Width setter.

**List Price:** *The Worksheet Utilities*, \$99.95 (with both 5 ¼- and 3 ½-inch diskettes). **Requires:** Lotus 1-2-3 2.0 or 2.01, 40K RAM, one disk drive, DOS 2.0 or later. Not copy protected. Funk Software, 222 Third St., Cambridge, MA 02142; (617) 497-6339.

CIRCLE 448 ON READER SERVICE CARD

### McGraw-Hill Transmits Current Business Info By Radio Waves to PCs

Executive One, from McGraw-Hill Information Management Co., delivers news and business information to your PC via FM signals broadcast in 11 major U.S. cities. The system requires you to buy a receiver (\$500). You will also need McGraw-Hill's software (\$150) and cables (\$19.50) to connect the receiver to the PC.

About 1,000 items per day come with the basic \$49.95-a-month service, which includes McGraw-Hill News; Standard and Poor's Markets and Financial Reports; Associated Press Online; Business Week; PR Newswire; and Stock Market Quotes. Optional services include the full feeds of PR Newswire and McGraw-Hill News (\$35 and \$34.95 extra per month), and Microbytes Daily, from *Byte* magazine (\$19.95 per month).

**List Price:** Executive One basic service, \$49.95; installation, free to \$300; satellite dish, \$150 (monthly) or \$2,495 (one-time). Optional services and monthly charges: PR Newswire full feed, \$35; Microbytes Daily, \$19.95; McGraw-Hill News full feed,

\$34.95. **Requires:** Data Receiver, \$500 (one-time); printer and computer cables, \$19.50 each; software, \$150. McGraw-Hill Information Management Co., 1221 Ave. of the Americas, New York, NY 10020; (212) 512-4551.

CIRCLE 445 ON READER SERVICE CARD

HOT PROSPECT

### Borland Enters Word Processor Fray with a User-Defined Interface

After distinguishing itself in the field of development software with its Turbo languages, Borland International is adding mainstream applications to its line. *Sprint*, its first word processor, is expected to ship later this winter.

*Sprint* could be the new word processor to replace your old war-horse, which may be familiar but lacks useful features. The program has its own English-like command set, with a so-called soft user interface. Borland claims that *Sprint* also emulates the interfaces of *WordStar* and *WordPerfect* and can share the files of those programs freely. It translates files from *WordStar* 2000, *WordPerfect*, Versions 4.1 and 4.2; *XyWrite II* and *III*; *MultiMate*; and *MultiMate Advantage*.

*Sprint*'s command set can be customized from a menu. Win-

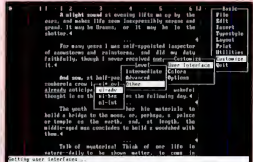
dowing capabilities let you have 6 files on-screen at a time and allow you to keep up to 24 files open at a time.

The program can create macros automatically; you can use this facility to write programs that emulate whatever word processor you like.

*Sprint* saves documents automatically, and you can set the interval between saves. Borland says that in the event of a power failure, the file you're working on in *Sprint* will be saved. When you power up again, the cursor will be where you left it.

**List Price:** *Sprint*, \$195. **Requires:** 256K RAM, two disk drives. DOS 2.0 or later. Not copy protected. Borland International Inc., 4585 Scotts Valley Dr., Scotts Valley, CA 95066; (408) 438-8400.

CIRCLE 441 ON READER SERVICE CARD



*Sprint*, Borland's new word processor, has a highly configurable interface. Pull-down menus are used for functions and commands. A beta-version screen is shown.



## PC UPDATE

edited by Peggy Gavan

**WordPerfect,  
Version 5.0**

**WordPerfect**, Version 5.0, scheduled to ship in March 1988, will integrate vector-based graphics with documents and pack powerful laser-printer support, giving the program abilities previously found only in desktop publishing packages. Version 5.0 will also import files from most popular graphics packages and will include support for CGM Metafiles, HPGL plot files, and TIFF files. **WordPerfect 5.0**, priced at \$495, will be available to registered users for a \$50 upgrade fee. WordPerfect Corp., Orem, Utah; (801) 227-4010.

**Clipper  
Summer '87**

The latest version of the **Clipper dBASE** compiler, **Clipper Summer '87**, executes up to five times as fast as the previous version and includes a rewritten menu-driven debugger. Additionally, the **Summer '87** release (which first began to ship in December 1987) offers optional **dBASE**-compatible indexes, easy access to low-level DOS files and devices, and completely rewritten documentation. **Clipper Summer '87** is priced at \$695. Registered users of the **Autumn '86** version are eligible for free upgrade disks. Nantucket Inc., Los Angeles, Calif.; (213) 390-7923.

**Chart-Master,  
Diagram-Master,  
Sign-Master**

The Ashton-Tate Graphics Service, a new offering from the company's Support, Services, and Information Group, provides users of **Chart-Master**, **Diagram-Master**, and **Sign-Master** with overnight delivery of color slides, color overhead transparencies, and color or black-and-white prints. The service works in



The Ashton-Tate Graphics Service provides Master-series users with boardroom-quality transparencies and slides.

conjunction with the **Master Graphics Express** utility package, priced at \$50. A minimum order of \$100 is required, although the company is offering an introductory 50 percent off the first order for registered users. Ashton-Tate, Torrance, Calif.; (213) 329-8000.

**R:base for  
DOS,  
R:base for  
OS/2**

Several Structured Query Language (SQL) commands are embedded in **R:base for DOS** and **R:base for OS/2**, major upgrades of **R:base System V**. In addition, **R:base for DOS** has multiuser features for use on local area networks, while **R:base for OS/2** offers multitasking and increased performance. Suggested retail prices: **R:base for DOS**, \$725; **Network Six**



Structured Query Language (SQL) commands and optimized system performance highlight the latest versions of **R:base**.

**Pack**, \$995; and **Network Unlimited**, \$2,695. Registered users who subscribe to one of Microrim's support services can upgrade for \$50, \$100, or \$200, respectively. Upgrades are \$99, \$200, and \$300 for all other registered users. Pricing for **R:base for OS/2** will be announced at shipment in early 1988. Microrim, Redmond, Wash.; (206) 885-2000.

**TOPS/DOS,  
Version 2.0**

**TOPS/DOS**, Version 2.0, allows users to access any printer or plotter that is attached to a PC on the **TOPS** network. The latest version also has **FlashTalk**, a newly released PC-to-PC communications architecture. **TOPS/DOS** has a price of \$189; upgrades are available to registered users for \$29 per node until March 15, 1988. Sun Microsystems recently acquired the maker of **TOPS**, Centram Systems, which is now known as **TOPS Inc.**; (415) 549-5900.

## IN BRIEF

**Lotus 1-2-3 Networker**, a version of **Lotus 1-2-3**, Release 2, designed for use with local area networks, supports up to five users on a file server at one time. **1-2-3 Networker** has a retail price of \$2,475; registered users can switch to the network version for five **1-2-3**, Release 2.x, system disks and \$250. Lotus Development Corp., Cambridge, Mass.; (617) 577-8500. . . **One-Write Plus**, Version 2.0, is not copy protected and features an automated installation procedure and optional standalone features for all four accounting modules. The new version, priced at \$250 per module, is available to registered users for \$50 per module until February 1 and \$75 per module thereafter. Great American Software, Amherst, N.H.; (800) 528-5015, (603) 889-5410.



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Actual photograph of Turbo C graphics displayed on IBM 8514 screen\*

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CIRCLE 137 ON READER SERVICE CARD

BORLAND







# Paradox: the top-rated relational database manager in the world

Source: Software Digest*		Software Digest Rating	Overall Evaluation		Program Name	Version Tested	Ease of Learning	Ease of Use	Error Handling	Performance	Versatility	Memory Requirement	Price
☆☆☆	8.7	Paradox	1.1	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	512K	\$495							
☆☆☆	8.2	XDB	1.10	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	320K	\$750							
☆☆☆	7.6	PowerBase	2.3	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	384K	\$349							
☆☆☆	7.0	Open Access II	2.0	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	256K	\$395							
☆☆☆	7.0	DataEase	2.5/2	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	384K	\$600							
☆☆	6.6	dBASE III PLUS	1.1	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	384K	\$695							
☆☆	6.4	R:BASE System V	1.1	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	512K	\$700							

**RATINGS KEY**  
(On a scale of 0 to 10)  
Overall Evaluation  
☆☆☆☆ 9.0 or higher  
☆☆☆☆ 8.0-8.9  
☆☆☆☆ 7.0-7.9  
☆☆ 6.0-6.9  
☆☆ 5.0-5.9  
All Other Ratings  
■ 7.0-9.9  
■ UNDER 5.0

**P**aradox\* is once again the top-rated program, with the latest version scoring even higher than last year's top score.\*\* (Software Digest's 1987 Ratings Report is an independent comparative ratings report for selecting IBM PC business software. Ratings Report tests were done by the prestigious National Software Testing Laboratory, Philadelphia, Pennsylvania.)

The Ratings Report message is crystal clear: there is no better relational database manager than Paradox. NSTL tested 12 different programs and amongst other results, discovered that Paradox is 3 times faster than dBASE\* and 6 times faster than R:BASE\* on a two-file join with subtotals test.†

## Paradox combines ease of use with power and sophistication

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David Schulman,  
Bendix Aerospace



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- 320K RAM
- Two disk drives, 5¼-inch and 5¼-inch suggested
- Compatible mouse, color, or EGA monitor with adapter

\*Paradox with permission by Software Digest from its July 1987 Report covering 12 relational database packages.

†For use designed and measured by NSTL, a 1,000-record and a 10,000-record file were created, a short and long test run 1,000 records file and a number of test runs on the 10,000-record file were executed using the 1,000-record file database. The short and long test runs were repeated in ascending order of the number of test runs. Subtotal for each group and the results added to a total average. Test times from the last experiment or the common database with other programs tested were recorded and averaged.

\*\*Rebate request must be received by Borland no later than February 15, 1988. Mail to: Paradox Rebate Department, Borland International, 4000 South Valley Drive, Suite 200, Scottsdale, AZ 85252.

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CIRCLE 161 ON READER SERVICE CARD



## COMMUNIQUE

edited by Bill Howard

## Amazing Facts I

"His LaserWriter has given him 2,000 maintenance free pages (he hasn't even changed the printer's ribbon)."

—Moneywise Magazine, reported in Toronto Sun, November 6, 1987

## Amazing Facts II

"[Tandy chairman Joho] Rouch said sales of the company's new personal computer based on the advanced Intel 80386 microchip were exceeding supply."

—Reuters story, November 12, 1987

## Amazing Facts III

"[NORCROSS, Ga.—Data-vue Corp. has opted to include a microprocessor in the hard-disk model of its Snap 1+1 lap-top, allowing the machine to run twice as fast..."]

—PC Week, October 6, 1987

## Amazing Facts IV

"[The Diconix 150-P portable printer:] so small and light; runs on rechargeable batteries or electricity."

—Ad by Print360, Smithtown, N.Y.

## Amazing Facts V

"[This [Miniscribe 3650 40MB hard] drive provides a blazing 61 ms access time—one of the fastest in the industry."

—PC Source ad

## Amazing Facts VI

"IBM also announced a new Model 80 with a 80386 processor that runs at 16 or 20 Mhz depending on disk size."

—Clark's Comments, November 1987 (Atlanta, Ga., consultant's newsletter)

Soviets say  
new IBMs  
don't violate  
SALT II pact

Especially not the Models 25 and 30.  
(Deseret [Utah] News,  
August 11-12, 1987.)

## For Power Users

"Exchanging Data Between Lotus 1-2-3, dBase III and other Word Processing Programs."

—Title of course offered by Data-Tech Institute, Clifton, N.J.



Black-jacketed disks, colored disks, and new chocolate disks: RSI Compu-Pak markets Swimsuit Disks. \$19.95 per case, with the slogan "We satisfy your drive." RSI president Barry Kukles (which is spelled that way so it doesn't sound like Kookles, he says) says he has gotten complaints both from NOW, which finds the disks sexist, and from men, who say the swimsuits are not revealing enough. (RSI/Compu-Pak, 7314 N. Lawndale Ave., Skokie, IL 60076; (800) 634-8650.)

## It's a Large Window

"For example, another member of the San Francisco users group continually runs an electronic blackboard in a background window while working on an application in the active window..."

—ComputerWorld, August 12, 1987

## Revisionist History

"Big Blue, which started the personal computer industry in 1981, took a look into the future and didn't like what it saw."

—Houston Chronicle, November 6, 1987, explaining IBM's decision to introduce the PS/2 line

## DOMINO'S PIZZA



Pizza, the breakfast of champion computer programmers. And now Domino's Pizza is marketing an extra Thick version



"Thank goodness you're here! I'm having trouble adjusting the laser printer."

Heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to *Communique's* PC Magazine, One Park Avenue, New York, N.Y. 10016, or MCI Mail 157-9201. Please print your name legibly; include the name, city, and publication date of any newspaper clipping; and include your T-shirt size. Contributors receive \$50 and a PC Magazine T-shirt. In case of duplicate entries, the earliest postmark prevails. Sorry, but entries can't be acknowledged.

Winners this issue: Victor Volkman (Domino's XT), William Ruckliffe (new IBMs), R. Grainger (LaserWriter ribbon), Steve Chandler (Tandy 4000), Bill Steele (Snap microprocessor), Hugh Ramsey (Diconix 150), Ronald LeClaire (blazing fast drive), D. C. Smith (Model 80 speed), Steven Spinella (data exchange), Steve Lasich (electronic blackboard), Tom Newman (IBM started the PC industry).





### **Stanford 386-18** XXXXXXXXXX **\$2058**

#### **9/18 MHz Zero Wait State 21 MHz Throughput**

- Intel 32 Bit 80386 CPU (18 MHz), 9/18 MHz software (keyboard) switchable clock
- Norton SI: 21 (Processor Speed)
- 200 watt P/S, 110/220V selectable
- CMOS memory, 16 channel interrupt, 7 DMA channels
- 512K interleaved 32 bit RAM on board
- RAM can be expanded to 16 MB of 32 bit high speed interleaved memory
- 2-32 bit, 4-16 bit & 2-8 bit expansion slots
- Supports 80387 math co-processor
- (Phoenix BIOS optional) Award BIOS
- High capacity floppy controller card
- 1.2 MB floppy drive
- Serial port (Com 1), optional 2nd serial port (Com 2), parallel port & (optional) game port
- Hardware Reset and Turbo L.E.D.
- Clock/calendar with battery backup
- Enhanced keyboard (101 keys)
- Complete documentation included
- High quality, heavy duty packaging

### **Stanford 386-16/1** XXXXXXXXXX **\$1979**

#### **6/16 MHz Zero Wait State 19 MHz Throughput**

- Same configuration as in System 386-18 except,
- Intel 32 Bit 80386 CPU (16 MHz), 6/16 MHz software (keyboard) switchable clock
  - Norton SI: 18.7 (Processor Speed)

### **Stanford 386-16/2** XXXXXXXXXX **\$1884**

Same configuration as in System 386-16/1 except includes socket for 80287 math coprocessor.

### **Stanford 286-12** XXXXXXXXXX **\$999**

#### **6/12 MHz**

- Same configuration as in System 286-16/1 except,
- 80286-10 CPU, 6/12 MHz Switchable.
  - 512KB 100 Nano Seconds, 0 wait state DRAM, installed

### **Stanford 286-16/1** XXXXXXXXXX **\$1344**

#### **10/16 MHz Zero Wait State 16 MHz Throughput**

Same configuration as in System 386-18 except,

- Compact size AT main board
- Intel 80286-12 CPU, 10/16 MHz software (keyboard) switchable clock
- Award BIOS, Norton SI: 15.9
- 1024KB (one megabyte) 80 Nano Seconds, 0 wait state DRAM, installed
- Selectable between zero wait state (10/16 MHz) or one wait state (8/12 MHz)

### **Stanford 286-16/2** XXXXXXXXXX **\$1169**

#### **10/12 MHz Zero Wait State 16 MHz Throughput**

Same configuration as in System 386-18 except,

- Compact size AT main board
- Intel 80286-12 CPU, 10/16 MHz software (keyboard) switchable clock
- Award BIOS, Norton SI: 15.3
- 1024KB (one megabyte) 80 Nano Seconds, 0 wait state DRAM, installed

### **Stanford 286-10** XXXXXXXXXX **\$948**

#### **6/10 MHz**

Same configuration as in System 286-16/1 except,

- Regular size AT main board & chassis
- 640K (120 N/S) DRAM on board
- Phoenix BIOS
- AT/XT style keyboard
- Hard disk and floppy controller card
- Serial/parallel/game ports are optional

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**EEMS RAM Card For 386 System** \$239

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**Xenix Multi-Terminal Card** \$599

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**Stanford 4.77/10** \$499

- 4.77/10 MHz, software switchable M/B
- Phoenix BIOS, Norton SI: 3.3
- 640K 120 N/S DRAM on board
- 360K floppy drive & controller
- AT/XT style keyboard
- AT Jr. case, XT size with AT features

**Stanford 4.77/8** \$399

- Same configuration as 4.77/10 MHz XT, except,
- XT slide case
  - 256K 150 N/S DRAM, Norton SI: 1.7

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NOVEMBER 24, 1987



JANUARY 12, 1988 • PC MAGAZINE

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■ BILL MACHRONE

# SERVING THE SCIENTIST



*Scientists and engineers really do use PCs differently. How can PC Magazine help them better, and most important, what can we learn from them?*

Every once in a while, some outside force breaks through the routine and demands your attention. I got just that sort of shake-up in the form of a letter from a reader, Bill Joyce. Bill is a scientist at AT&T Bell Labs, and he says, "PC Magazine is the only periodical that I regularly read from cover to cover (it is much more interesting than the periodicals in my own field)."

In his letter, Bill recognizes that PC Magazine is geared to business and professional users of PCs. We aim for the generalists, not those who are interested only in dental office management packages and other highly vertical—and therefore highly routinized—applications. Scientists and engineers don't do routinized things, any more than do product managers, market analysts, and magazine editors.

Bill feels that this is fitting and just:

"Although I would always welcome more articles for scientists, the main point of this letter is to suggest that you simply add a few more remarks about the concerns of scientists and engineers in your normal articles."

**IN A SCIENTIST'S SHOES** That, of course, interests me, since engineers and scientists are close on the heels of DP/MIS people as the second-largest number of occupation-specific readers. Anything I can do to help a quarter of our readers, I'll do. And besides, Bill's making it easy for me. He doesn't want whole articles that would turn off everyone but an engineer. He just wants us to put ourselves in his shoes long enough to see how a product affects the

plight of the engineer and scientist.

Bill says:

"Almost everything I write includes some Greek letters and math symbols from the IBM high-character set. When I read a review of a word processing program, I wonder how easily the program maps those characters to the keyboard. My other big concern is over the difficulty of writing or editing a few built-up equations in text mode. (For heavy math, I still have word processing done for me, but I'm hoping to do even that on a PC with a laser printer soon.) I'm always particularly interested in new and better ways to get the rest of the Greek alphabet and some more math symbols, particularly if they will also appear on the screen. The most important thing that a review of PCs could do for someone like me is warn that those brands won't take the Hercules Graphics Plus Card (I managed to buy one that won't)."

This is an excellent point. As much as

we keep hammering on how important a WYSIWYG display is for business users, it's an infinitely more important consideration for scientists. After all, what's the point of technical publishing if you can't preview and edit the very things that make your point?

Which leads, of course, to output. Printers are still a bunch of maverick devices that staunchly defy your best attempts to get them to do what the manufacturer says they do. Referring to one article, Bill continues:

"The review says that the LQ-850 has the high characters, but does this mean it has them with every draft- and letter-quality font and every emulation? Is there a difference between the Greek letters in the two letter-quality fonts cited in the review? The review says there are optional font cartridges. Are any designed for scientists? If so, do they make sense? (A cartridge that adds symbols but throws out the alphabet is not very helpful. And one that changes the keyboard mapping of any retained IBM characters and symbols is not much better.)"

Good questions all. And a challenge to us to ferret out the answers as we look at printers in future issues. The greater challenge, though, is to convey that much information succinctly and comprehensibly—for each of a hundred printers. We'll find a way.

**INTERESTS IN COMMON** Advanced features need not be interesting only to scientists, either. For example, subscripts and superscripts are the way we indicate pow-





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## ■ BILL MACHRONE

ers of numbers and sequences of numbers in mathematics. But they're vital to anyone who needs to annotate text. Students, documentation writers, professors, and others need superscripts. Bill has had some rueful experiences that we can all learn from:

"WordPerfect has them, but it takes two extra keystrokes. First you have to hit the sub/super key. Then you have to choose sub or super. Probably the biggest disappointment in my life as a consumer came when I bought the HP ThinkJet printer on HP's assurance (over the phone) that it does subs and supers. When the printer came I found that the carriage has unidirectional feed. The instruction manual says to print all the supers on a given line before you make the half-line advance, then print all the on-line characters. A remark in a review could have saved me."

In truth, there are a few word processors that can correctly format subs and supers on a half-line printer (WordStar has always done it), but the point is well taken. If we look at any printer from an engineer's perspective, anyone who needs those features will benefit from the additional information.

**LEARNING FROM SCIENTISTS** We can learn from scientists in other ways. Right now, if you needed to noodle around with some numbers—nothing so formal as a budget, but more than you could keep track of with your four-function calculator—what would you do? Right—you'd fire up your favorite spreadsheet and translate your problem into rows, columns, and cell formulas. The engineers among us, however, would be far more likely to bring up MathCAD. It treats your screen as a blank pad or a blackboard. You write formulas or type in a matrix or a series of numbers. You graph the results. You use the results of old calculations in new ones—anywhere on (or off) the screen. This scheme is far less bounded than a spreadsheet, and more conducive to the steady flow of ideas. Nonengineers can learn from that and use unfamiliar metaphors to solve common problems—by cross-pollinating.

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■ JOHN C. DVORAK

# THE NEW AGE OF CHAOS



*With the Golden Age of Compatibility now drawing to an end, the future of the personal computer is spelled out by history: 5½ years of chaos.*

Cycles are everywhere. The cycle of sunspots is 22 years: 11 years on the upswing and 11 years on the downswing. The microcomputer scene has an 11-year cycle: 5½ years on the upswing and 5½ years on the downswing. While I may be hasty in identifying this cycle, I think it will be shown that we are on a downswing and beginning a return to the chaotic age of personal computing that predated the introduction of the IBM PC.

The years between 1976 and 1981 had the following earmarks: (1) a strong push by Apple to dominate the market, with some success; (2) on the other side of the fence, CP/M computers, which supported a variety of incompatible disk formats; (3) a change from 8-inch floppies for "serious" business machines to 5¼-inch diskettes; (4) extensive software patching needed to run a variety of incompatible printers; (5) display I/O a chaotic mess, with each terminal manufacturer using its own set of cursor controls, resulting in a laundry list of possibilities that needed to be patched into most software packages.

By the time the IBM PC appeared, the scene was ridiculous, with powerful and dinosaur like CP/M machines built out of heavy steel, each containing beastlike nonswitching power supplies, and each hooked to any one of a thousand display tubes, minicomputer style. The software code was tight and polished, and most 64K machines could do amazing things—especially when equipped with loads of memory used as a RAMdisk to permit quick swapping of the many overlays necessary to run programs that were larger than 64K.

Most printers were as singular as the VDTs, and each user had to write a custom I/O routine and hand-patch it into the operating system. Let's not even begin to discuss modems.

**THE GOLDEN AGE** After IBM arrived, things changed radically. The Age of Chaos was ending; the Golden Age of Compatibility was beginning. No more I/O routines. No more weird screen drivers. The 5¼-inch disk was stamped with approval—in one format, not dozens. There was now 640K available for programs, not 64K. Forget about overlays and memory constraints. A new cadre of nerds pushed aside the old cadre, who stuck by their soon-to-be arcane CP/M systems.

On the other side, Apple was stunned and began to fade as *VisiCalc* users turned to the familiar IBM logo and the PC version of *VisiCalc*. The coffin was nailed shut as the *VisiCalc* manufacturer had in-

ternal feuds and self-destructed, allowing a Lotus to emerge from the mud (hence the name). Lotus was PC all the way, and Apple was out of luck. By 1984 it was all IBM PC and the clones. Compatibility and tranquility ruled the land.

Time flies. The Golden Age of Compatibility ended, destroyed by the same hand that made it flourish, its breakdown helped by the cycle. (A cycle that has as much to do with the development of new semiconductors as with anything.) IBM announced a PS/2, OS/2, and the VGA. The results: a predictable turmoil.

As the new Age of Chaos begins, we feel we're back to square one in some grim, never-ending Monopoly game. On the other side of the fence stands Apple and its line of Macintoshes—in the catbird seat as it was a decade ago.

Looming: we see strange and incompatible printers, a myriad of display tubes that need special patching, a laundry list of upcoming display cards (all incompatible), software that needs overlays in the form of memory-resident programs, and LIM and *DESQview* with promises of a cure, with OS/2 sounding like the UNIX promises of old. Confusion reigns as we try to adjust to another round of mania.

The education process begins anew, too. Expect a new proliferation of books and magazines in the next few years as everyone jockeys for hegemony by backstabbing and bad-mouthing everyone and everything. Bankruptcy, sore losers, too many new products, bad decisions, dumb ideas will be everywhere. Déjà vu.

I like it.





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■ JOHN C. DVORAK

# INSIDE TRACK

*A new operating system, a new chip, a new CD-ROM player. What more could you ask for?*

**Trend Dept.:** Is this the next hot operating system? **Hellooooo Wendin-DOS.** Wendin Inc. has been around since 1980 and now has an operating-system wunderkind grinding out code as if there's no tomorrow. Wendin-DOS is a 640K-barrier-breaking operating system for the AT and the 80386 machine. Unlike oddball systems such as THEOS, this baby is 100 percent MS-DOS compatible; all the old programs run as they used to, without modification. It's multitasking and multiuser, and it's not a shell. It boots and goes. Price \$99. While I have yet to set up a system with this thing, I've met all the guys and they seem credible and sincere and fun. Worth a look.

To prove that Wendin has what it takes to do an operating system, the company provides two other operating systems for the insatiable OS nut cases. The first is PC/VMS. That's right—it's a VAX operating system for the PC. Then there's PCNX—a UNIX clone. Each of these is \$99 including the source code! The company also sells an editor, toolboxes, and a developers' kit for Wendin-DOS. Call or write Wendin Inc., Box 3888, Spokane, WA 99220; (509) 624-8088.

**The Last Comments About a New Chip Dept.:** The latest information about the new Intel P9 chip indicates that (horror of horrors) this 16-bit version of the 80386 is **not pin-compatible** with the 80286 as expected. If you've been following this column, you know that the P9 chip is positioned to stifle sales of the 80286 chips, specifically those high-performance versions made by AMD (a licensee of Intel that is in a blood feud with Intel, because Intel refused to grant it a license for the 80386). The hoped-for result of all this is a concentration of ef-

fort in the profitable 80386 arena.

This attempt to ruin the 80286 market would be better executed if the P9 chip could be dropped into an 80286 socket—but no. Now, to use the thing, all the designers have to redesign the motherboard or kludge together a piggyback board (shades of 1980!) to shove into the old 80286 socket. I'd say the 80286 has been given new life by this blunder.

To compound this marketing fiasco, it seems that Intel may not give the new chip the obvious 80388 moniker. This designation would wisely associate it with the 80386 in the minds of the users. The company may instead release another chip to be dubbed the 80388, designed to be used as a dedicated controller, and inappropriate for use as a general-purpose microprocessor. **This, to me, is unbelievable.** Unless things change, the P9 is doomed to the destiny of the ill-fated and long-forgotten 8085—a previous Intel marketing botch.

**Genuinely Interesting but Buggy Software Dept.:** I have to give Microsoft kudos once in a while for promoting good ideas. The CD-ROM technology is a good idea that needs promotion. *Microsoft Bookshelf* is a \$299 CD-ROM disk that contains, among other things, a thesaurus, *The American Heritage Dictionary*, a spelling checker, an almanac, *Bartlett's Familiar Quotations*, and the U.S. ZIP code directory.

As you may have noticed, a slew of reviewers praised this product over the past 6 months, but few use it. I use it all the time. Here are a few of the many irritations and bugs I've found so far: the ZIP code directory tells me that Box 275 in El Cerrito, California, is 91720 when it's 94530. Obviously, it can't be trusted. The ZIP code can be easily inserted into a

WordStar document, but you can't make inserts from the thesaurus. The spelling checker won't work at all on a file but will check individual words one at a time—it's useless. *Bartlett's* is useless just because it's *Bartlett's*.

Also: there is a file containing some of the dumbest forms I've seen, an unusable English usage checker, and some other stuff. Furthermore, when you boot up, the driver for the Hitachi CD-ROM disk drive from Amdek fails on first try, requiring you to type R for "retry." Microsoft tells me that Hitachi supplied faulty device drivers. What? Microsoft's horde of programmers can't fix this?

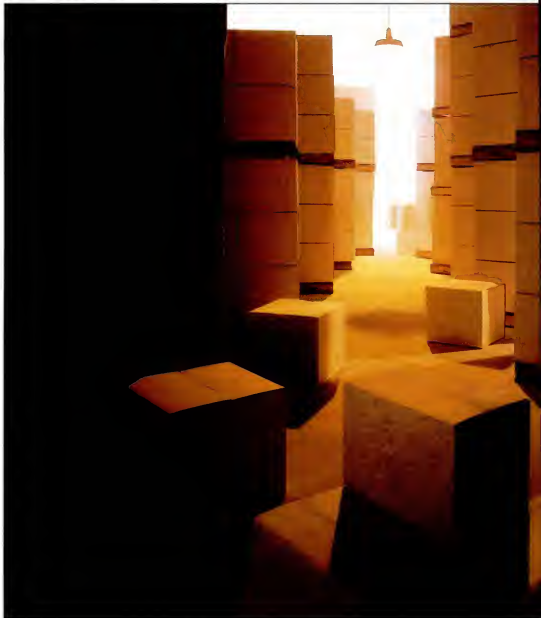
Finally, the biggest joke is that the dictionary will look up a word on the screen, but once in the dictionary, if you want to look up another word, you have to leave the program and start over. I can imagine some illiterate programmer at Microsoft saying, "Gee, why would anyone want to look up two words?"

These complaints notwithstanding, this is a package worth considering if you do any writing. I can't tell you how handy it is to have a dictionary on-line so you can look up an obscure word instantly. Too bad it wasn't a better dictionary. Golly, maybe I shouldn't recommend this thing after all. **Version 2.0 should be better.** They have the right idea.

**While on the subject of CD-ROMs,** one of the niftiest players I've seen is from Toshiba. It's designed to fit into a half-height floppy slot and uses the new Philips disk carrier/cartridge to load the disk. This cartridge was first shown by Philips last year and was released into the public domain. You hand-install your disk into it; from that day forward the disk is never touched. The cartridge is then shoved into the front of the player like a floppy. It's a good idea and it's the only solution to eliminating the large sliding drawer used on most CD players. The drawer, while high-tech, takes up too much space. ☐



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## ■ JIM SEYMOUR

# UND ZEN I SEE . . .

*Seymour looks into his crystal ball to perceive exciting developments you can expect in the PC software arena during the coming months of 1988.*



**C**rystal-ball gazing is always fun, though it exposes the gazer to the risk of ridicule (if time and events prove him too far off the mark) and opens his audience to the risk of penury (if they believe everything he says and put their money where his mouth was).

From our perspective here in early January, it's tough to know with certainty what will be hot during 1988. But I've spotted five areas I think will be hot in PC software during 1988. Given the caveat above—would you like me to hold onto your wallet for a while?—here goes.

**SCHEDULING ORGANIZERS** One of the hottest corners of the software business in 1988 is likely to be *scheduling software*. Fueled by Lotus's rollout of *Agenda*, scheduling and tracking software is going to get a lot of attention.

*Agenda* will get a lot of press, if only because as Mitch Kapor's baby for his last couple of years at Lotus, it will answer a lot of "What's Mitch been up to?" questions. A solid product, it will test both its own metaphor for capturing, linking, and retrieving the bits of information flotsam and jetsam that slosh across our desks, and our real interest in "finally getting organized."

*Agenda* won't be alone, of course; we already have *DayFlo Tracker* from DayFlo Software ((714) 474-2901) and *Primetime* from Wiseware ((714) 556-6523). While neither is as ambitious as *Agenda*, both are good. *Primetime*, an excellent product, may be one of the sleepers of the year.

**CLEAN SHEETS** A second hot area will be new spreadsheets. If you think the first volleys of the Spreadsheet Wars of 1987-88, a couple of months ago, were interesting, just wait 'til spring. You ain't seen nuthin' yet.

With Lotus preparing to ship *1-2-3, Release 3*, sometime late in the first half of the year, the publishers of *Quattro*, *Microsoft Excel*, *Surpass*, and *Lucid3D* will face their last chance to grab market share before having to compete head-to-head against the new *1-2-3*. (They've been going up against its shadow all along, of course; Lotus began leaking details of *1-2-3, Release 3*, long before Microsoft rolled out *Excel* last October.)

Then later this year—assuming OS/2, Version 1.1, is ready—we'll see *1-2-3/G*, running under the graphical interface of Presentation Manager (a.k.a. *Windows* 2.0). That will make the fall campaigns in the Spreadsheet Wars bloodier still.



Lotus has been candid that *1-2-3, Release 3*, is only an incremental (if still important) upgrade of the product, very much bound by the limitations of the character-based world. But *1-2-3/G* is the full-blown "next-generation" product, which Lotus thinks will stand up to comparison with any other spreadsheet (read *Excel*).

Look for a thunderous introduction for *1-2-3/G*, no matter how well the un-Lotus spreadsheets have done up till then. (And if they've done very well, bring the kids and pets indoors and pull the drapes; it's going to get scary.)

**OPEN A NEW WINDOW** Speaking of *Windows*, we'll also finally begin to see more *Windows* applications throughout 1988. Now that we have a stable, fully functional version of *Windows* in Release 2.0, and especially with *Windows/386*'s excellent performance on fast 386 PCs loaded up with extra memory, the *Windows* era may finally be here. Even if we'll eventually have to learn to call it Presentation Manager.

With *Microsoft Excel*, Blythe's *Quartz*, and *Micrografix's Windows Graph*, we've got three of the Big Five PC applications covered with superb products. Add a good communications program and an up-to-date, fully featured word processor, and we'll have a suite of programs that will allow the *Windows*-shy to finally begin testing the graphical-interface waters without the compromises of stirring a few "old apps" into the mix.

Keep your eye on Microsoft for that killer WP program for *Windows*.



## ■ JIM SEYMOUR

**DESKTOP PUBLISHING** So-called "converged WP-DTP" software will also be big this year. The leading WP programs have been picking up desktop-publishing-like features for the last 18 months.

Thousands of businesses have discovered the heartbreak of DTP: taking a morning to produce a memo, a day and a half to produce a proposal. Not every letter or proposal needs to look *that* good. Though

templates can speed the process, the inherent fiddliness of DTP work makes it slower than straight word processing.

So the WP vendors are adding line drawing, box drawing, multiple justified side-by-side wrapped columns. . . . The list is long. That will continue, including the addition of page previewing, and the ability to insert (and scale and reposition) graphics in WP documents.

PC Magazine executive editor Paul Somerson has been arguing for 2 years that DTP is less an application than a mere technique. In 1988 the WP market will be working hard to prove him right.

Finally, we'll see more 386-specific software packages. Symantec jumped in with a 386 version of Q&A in the middle of 1987. Parts of the program run about twice as fast as the regular version when both are loaded on the same 386 PC, proving the value of recompiling.

Borland has promised a 386-specific version of *Paradox*, which should show a dramatic improvement, especially in search times through large data-

■ OS/2, Version 1.0, is much more a developer's tool for learning how to write OS/2 applications than a platform on which to deliver them.

bases—particularly for those 386 users with lots of RAM. We'll see other 386-specific applications throughout 1988.

That's it: five hot categories. What? No OS/2 entries? Not yet. OS/2, Version 1.0, is an uninteresting product for end users, much more a developer's tool for learning how to write OS/2 applications than a platform upon which to deliver those applications. That will be the role of Version 1.1, with the Presentation Manager interface—and it'll be next year before we see many interesting PM packages running under OS/2.

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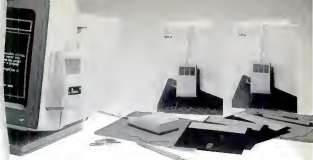
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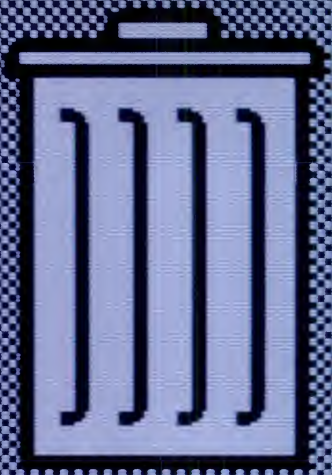
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■ STEPHEN MANES

# HOW HARD IS HARDWARE?



*Which is easier: designing computers or developing software for them? The answer depends on your point of view—and your job description.*

“Junk!” grunted Doughboy, kicking the coffee maker. “Damned hardware!”

“What did I hear you say?” scolded Flint, coming through the door with his empty cup.

Doughboy aimed a sneer in Flint’s direction. “Forget about caffeine, pal. This java jukebox is on the fritz again. Another crack job of hardware design.”

“Don’t get snippy,” said Flint, examining the coffee maker. “Hardware’s hard.”

“And just what is that supposed to mean?” Doughboy demanded.

“Mean?”

“I caught it. You’re implying what I do is easy.”

Flint grinned. “Who, me?”

“Well, you’re full of solder. Writing software is hard. Damned hard.”

Flint just smirked.

“Harder than hardware?” Doughboy insisted.

Flint began tinkering with the coffee maker. “Let’s not be ridiculous.”

“Ridiculous?”

“Ridiculous. Hardware is much harder to develop than software. No contest.”

“See? You *were* acting superior. Hey, all you do is design boxes and stuff them with off-the-shelf parts. It’s up to us to make them useful.”

“Give me a small break. We deal with physical reality. You merely move symbols around.”

Doughboy bristled. “And just what is that supposed to mean?”

“Only that we have to deal with hundreds of things you don’t even have a clue

about. Take the JTZ-11 for instance.”

“Please.”

“Very funny, Henny. It may not be our top of the line anymore, but it still outsells everything else.”

“There’s one born every minute.”

“Fine. You prefer the Model 57. Me, too. And everything about it required a conscious, irrevocable decision, right down to the color of the case. It’s not like software, where the only costs you have to worry about are programmers and machine time. We use parts that cost money. We have to work within a budget. Do we use off-the-shelf chips? Do we design our own? Will they work the way they’re supposed to, or will weird things happen when we actually put them together?”

“Same with software. You try something new and it works, but it may screw up something else you hadn’t thought about.”

Flint nodded. “Precisely. The differ-



ence is that in your case, you move a few characters around and test the fix the instant you figure it out. With hardware, we actually have to *build* the fix. Come watch us analyze signals to figure out why we’re getting spurious noise or a voltage that doesn’t come up to the specs. We get unexpected interactions all the time. And we’ve got space constraints. Did you ever consider what it means to get real functionality out of a PS/2-size card?”

“We’ve got limitations,” Doughboy pointed out. “Ever hear of 640K?”

**GETTING PHYSICAL** “Sure. But our limitations are physical. Real. You can swap stuff in and out of memory. We don’t generally have access to little motors that flip chips on and off our boards.”

“True,” Doughboy admitted. “But tell me this: if hardware’s so hard, how come it’s generally so good—this infernal coffee machine excepted? And if software’s so easy, how come it’s generally so bad?”

“Apparently,” Flint replied dryly as he began reassembling the coffee maker, “the software field attracts inferior sorts.”

“Answer the question. Hardware keeps getting better, cheaper, faster in leaps and bounds every year. Software just seems to inch forward. How come?”

“I reiterate: it’s created by inferior beings.”

“Wrong. The reason hardware is better than software is that it takes less magic—less creative spark.”

Flint scowled. “Oh, gag me with an algorithm!”

“Seriously,” Doughboy pressed.



## ■ STEPHEN MANES

"Hardware has a fairly simple goal: putting together a box that works. Software's goal is more subtle, more refined: pushing the box to its limits."

"Ha! You don't even have to worry

about actually producing the product, or figuring out how to make it last, or how easy it'll be to repair. All you do is send out a floppy disk."

"Ha, yourself! The truth is that systems

always have better hardware than software. Take these new phone systems: they do everything but fry clams, but nobody can figure out how to use them because the software's screwy. Or take the movies: the basic technology's been in place since before the turn of the century. The hardware does what it does. But how many great movies have there been?"

"More than the number of great projector designs, that's for sure. Besides, there are plenty of places where software outstrips hardware."

"Such as?"

"Music. There are probably thousands of fine melodies—first-rate software—running around in your brain. But there's still not one electronic system that will reproduce the sound of an orchestra with 100 percent accuracy. Creativity is wonderful, but the truth is it's easier to compose a tune than to line up hundreds of tiny electronic circuits. And software is getting better a lot faster than you let on. In just a couple of years, we've gone from two-bit word processing to full-fledged typesetting and layout."

"Sure: in response to higher-resolution monitors and printers, which you guys toss off in your sleep. Software playing catch-up with hardware again. Look at the demo: RCA introduces its new DVI chip to cram video onto compact discs, and what do they demonstrate? Flight simulators and girls on water skis!"

"Like I say, lack of imagination. Okay, we have coffee lift-off here."

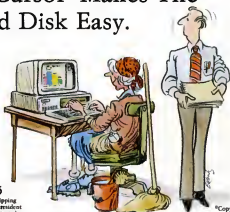
"Proves my point. Hardware is easy."

"Fill your cup and wake up those brain cells! Bottom line: I can write software; you can't design a board. You wouldn't know a fast Fourier transform from copper-clad molybdenum if both of them cold-soldered you to a substrate."

"I suppose you're well acquainted with the Knuth hyphenation algorithm." "sniffed Doughboy, pouring himself a cup of joe. "Hey, you're lucky if you can program this coffee maker to turn itself off."

Manuel, the chief technical writer, burst in. "I knew it! The minute I saw those incomprehensible specs you guys handed down, I was positive I'd find you in here slacking off. Man!" he sighed, slumping down in a chair. "I must have the toughest job in the world!"

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Hayes 1200B	Call
Hayes 2400	Call
U.S. Robotics 2400	335
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# THE CHEAPEST ATs EVER

**Y**ou're shopping for your first computer, or perhaps a second machine to let you continue the day's work at home. You want to put PCs on every desk in your office without busting the budget. You want to buy a cheap machine that has the technological capability to be viable into the future. Should you be considering inexpensive AT compatibles? Yes, yes, yes, and yes.

PC Labs put out the call to every manufacturer and marketer of inexpensive ATs, and we've thoroughly evaluated the 21 machines that arrived for testing—machines from ANI, Altec, AMT, Bentley, CompuAdd, CCI, Dell Computer (PC's Limited), 47th Street Computer, Logix, Lucky Star, Micro 1, Northgate, OPC, Pan-United (Micro Lab), PC Craft, PC Designs, Proteus, 786 Computers, SCSi, Vector, and Wall Street Computers. We've also taken another look at four name-brand favorites—the AST Premium/286, the Epson Equity III Plus, the NEC APC IV PowerMate 2, and the Tandy 1000 TX—that, when bought at a good discount, become price competitive with some of the lesser-known mail-order machines.

Competition has pushed the prices of 80286-based systems down to levels that would have been attractive for 8088-based machines just a few years ago. AT compatibles are now commodity-like items; there is little basis to distinguish one from another in the minds of most buyers, so price has become the dominant selling point. One result: some of the major players in this market are mail-order companies that put the systems together and sell them directly to the buyer without the burden of middle-level markups.

Some mail-order firms like Dell Computer (which manufactures PC's Limited computers) and CompuAdd (which mar-

*Anyone shopping for an AT-class computer these days would be foolish to ignore the multitude of inexpensive machines available through mail order and direct sales. PC Labs takes a look at 21 top contenders.*



## ■ LOW-COST ATs

kets computers under several names including Bentley, PC Source, United Solutions, and IMS) have high visibility, and their products are close to gaining brand name status. Others are more obscure, using little more than a custom-printed nameplate on the outside of a generic chassis to identify themselves.

Many of these mail-order houses have filled a niche that once was occupied by system integrators. Back in the late-1970s heyday of CP/M computers and the S-100 expansion card bus, you could buy all the components for a computer from a variety of sources. Unfortunately, in order to get your CPU card talking to your disk controller, you often had to find someone to write a custom BIOS. This role was filled by system integrators, who built computers one at a time.

These days there is much more standardization in the world of PCs. You can buy motherboards, IBM-compatible BIOS chips, controllers, and display adapters, install them in a chassis, and throw in a keyboard—and there's a pretty good chance that the thing will work. The potential sales volume is great and the means of reaching millions of prospective buyers more available than before, so yesterday's system integrators have evolved into today's mail-order PC houses.

**WHY BUY?** There are plenty of low-priced ATs to consider, but why buy one at all? Hasn't 80286 technology been rendered obsolete by the IBM PS/2 family and the explosion of 80386 machines?

True, the PS/2s offer some clear design advantages over older PCs, especially in the new Micro Channel architecture, which has higher transfer rates, smarter arbitration, and a sophisticated series of mini-coprocessors. But you don't find those advantages in the PS/2 Models 25 and 30, which also use the less-powerful 8086 processor. A cheap 80286 machine will clearly outperform the Model 30, and to move up to the Model 50 (\$3,595) or Model 60 (\$5,295) will take your budget beyond \$2,000.

Compared with the inexpensive machines reviewed here, 80386-based computers with the AT bus design cost at least \$1,000 more (the stripped-down ALR 386/2 lists at \$1,990, the Tandy 4000 at

\$2,599, the PC's Limited 386-16 at \$4,499); in fact, they can run as high as \$10,000 more (for the top-of-the-line Compaq Deskpro 386/20). The 386s offer real advantages in speed and have guaranteed viability long into the future. Remember that a 12-MHz AT can approach the performance of some 386 machines. The most significant point is that 386s can run some of the new operating systems that will not work on a 286 (notable examples include Concurrent DOS 386, PC-

---

*If you're planning to  
spend \$1,500 to \$2,000  
for a system that  
includes a monochrome  
monitor and a hard  
disk, the low-cost AT  
may be your best bet.*

---

MOS/386, and SCO Xenix/386). They are not yet in wide use, and, given the huge installed base of ATs, it is likely that many new operating systems will work with the 80286 processor as well; but for now, 386 machines are on the true cutting edge.

The biggest operating-system news is OS/2, which will run on PS/2 computers (excluding the XT-in-drag Model 25 and Model 30), 386 machines, and most—but not all—AT-class machines. No one knows how much impact OS/2 will have on the marketplace, but it is a good idea to make certain that OS/2 is an open option for you. We tested all 21 machines for their ability to run a beta version OS/2; 13 of the 21 passed.

If an AT compatible is as good as some of the top options, why not go even further down and get an 8088/8086-based PC clone? We chose not to review low-cost PC clones as we did in "The Cheapest PCs Ever" (*PC Magazine*, October 14, 1986) because they now exist in a true commodity market. Their prices, which ranged from \$507 to \$1,099 then, have continued to tumble over the past 15 months, but the

difference in cost between a fully configured PC-class and AT-class machine is often only a few hundred dollars. For this relatively small increase in cost, you get a machine that will run 2 to 10 times faster than the original PC, can run OS/2, and can accept megabytes of RAM.

For example, it's exciting to see the CompuAdd Standard Turbo/8 PC compatible priced at \$399. Next to that price tag, CompuAdd's Standard 286/10 AT compatible, at \$995, seems overpriced. But by the time you configure both machines with 512K RAM, a monitor and card, and a 20-MB hard disk, the prices hover around \$1,000 for the PC and \$1,400 for the AT. Once you've gone that far, you might as well take the extra step.

Therefore, if you're planning to spend \$1,500 to \$2,000 for a system that includes a monochrome monitor and a hard disk, the low-cost AT may be your best bet. But how can you choose from so very wide a field?

As always, you'll confront a quality-versus-price tradeoff. The more expensive machines often have a sturdier design with better-quality parts. In some low-cost machines, you may find that the case does not fit precisely or the connecting hardware is made from cheap metal. The expansion cards may well be Taiwanese or Korean designs that mimic brand name originals. Keyboards may be flimsy, with no tactile response. And the final sacrifice is that some of these knock-off components may not perform like the originals, resulting in compatibility conflicts.

**POSITIVE SUPPORT** Another important issue is support. If you are an experienced user with a half-dozen PCs and ATs already installed, you probably feel comfortable inserting expansion cards, attaching cables, configuring ports, and initializing hard disks. If you are new to PCs, however, you may be completely baffled by a set of five unlabeled D-connectors on the back of the computer, not knowing which one will speak politely to your printer and which might result in a meltdown.

Support comes in the form of documentation and telephone access, and we found a wide range of support quality as we evaluated these machines. A few of the cheap ATs are suitable for first-time users be-



cause they come with well-written instruction manuals filled with clear illustrations, backed up by a knowledgeable and accessible support staff. On the other hand, one computer arrived with less than 2 ounces of documentation, which literally does not say much for the product.

**SERVICE** Nearly every machine covered here comes with a 12-month warranty covering parts and labor, which should give you some reassurance, especially if you are shopping by phone. In most cases you'll be required to send the computer back to the company for warranty service, but most companies split the shipping; you pay to send it to them and they pay to send it back. Watch out, because a few have different policies: either the company pays both ways (nice) or you pay both ways (not so nice). The Oriental Precision Co., manufacturer of the OPC-286, offers local depot service through national service companies.

Warranty service is fine, but the company has to stick around to honor the warranty. Many of these mail-order firms can be characterized as small operations, and there is a clear and present danger that some will drift off in the night as quietly as they came. But if the computer is built with standard components, you should be able to get service from any local hardware service company.

Standard components means items such as the Western Digital WA2 combination hard/floppy controller; Phoenix, Award, or Eden ROM BIOS; and a motherboard based on the Chips and Technologies AT chip set. Other items such as display adapters and I/O boards cost too little to bother repairing at all; you are better off just buying a replacement. If your machine uses a proprietary controller or BIOS, however, you may find it more difficult to get service.

**CAVEAT READER** As you are discovering how these 21 computers measure up in the reviews that follow, there are a number of important points to keep in mind. First, we asked each company to send one computer, configured with a monochrome monitor and some kind of hard disk, a complete system priced as close to \$1,500 as possible. In every case, we had hoped to

get the very least expensive machine available from the company, but in some cases the company chose to send a slightly more expensive model that they hoped would perform better, because of a faster clock speed or higher-quality hard disk.

Most companies produce these computers à la carte rather than from a small list of preset configurations. You want a hard disk? Fine: 20, 30, 40MB or larger? You want a 40MB drive? Fine: do you want 65-, 40-, or 28-millisecond perfor-

*Almost every computer  
we tested arrived  
with DOS installed  
on its hard disk,  
but only six came with  
any kind of DOS  
documentation or disks.*

mance? Do you want 512K, 640K, or 1MB of RAM? Do you want the "house brand" BIOS or Phoenix? Do you want a monochrome display adapter, monochrome graphics, CGA, or EGA? Small or standard case? Original AT-style keyboard or the new IBM Enhanced style? With 6-, 8-, 10-, or 12-MHz performance? Almost all the companies offer one or more of these choices, which means that they offer dozens of different configurations, many of which rely on different motherboards. So, don't take our descriptions as the ultimate word on what these companies offer.

Similarly, don't count too much on the brand names of some of the components. For example, you may order a machine and find that where we got a Fujitsu floppy disk drive, you get a TEAC. Such interchangeable components can vary with fluctuating prices and altering design specs.

PC Labs evaluated two computers that came with Everex disk controllers, and by the time that the reviews were finished, both companies—Vector and Wall Street Computers—were shipping their ma-

chines with Western Digital controllers.

Finally, you should realize that prices in this market are anything but stable. Our Fact Files and features table represent what is best considered a snapshot of the market as it looked in late 1987. Given the state of the world economy and the performance of the dollar against foreign currencies, the only statement we can make for certain is that not all of these prices will still be valid when you read this. Don't read a review and then write out a check based on the Fact File. Instead, treat these figures as points of comparison; they tell you who is more or less expensive than the competition (but even that can change).

To help you compare apples with apples, our features table lists four different prices: the base system price (at least 512K RAM and one 1.2MB floppy disk drive), the monochrome system price (including monitor, display adapter, and hard disk), the EGA system price, and the tested configuration price.

**DEALING WITH DOS** Don't expect DOS to come automatically; it is not always part of a system's base price. Some shoppers may not realize that they need to pay the extra \$80 to \$120 for the operating system before they can bring the machine to life.

Almost every computer we tested arrived with DOS installed on its hard disk, but only six came with any kind of DOS documentation or disks. In almost every case (with one notable exception), the company representatives explained that this was done for our convenience, and that they never install DOS on the hard disk unless it is purchased at the same time by the buyer. If a company provides an unlicensed and undocumented copy of DOS, this is not only illegal, it is also a disservice to the buyer, who is stranded without the support documentation necessary to make DOS work.

According to a Microsoft representative, such a practice would be in direct violation of copyright laws. The irony is that it costs so little to buy the right to distribute MS-DOS as part of a system. The cost varies with the number of systems sold but typically should be about \$25 or \$30 per machine. Even in the cutthroat business of low-end marketing, this additional 2 per-



## ■ LOW-COST ATs

cent of the purchase price of a \$1,500 AT should be an affordable cost for a manufacturer to bear.

**HARDWARE DECISIONS** You should consider two additional factors as you shop.

The first is keyboards. The ones supplied with these machines were uniformly poor. In most cases they had no tactile response, and it is no fun to spend hours a day working at a mushy keyboard. Unfortunately, this is something you simply can't judge when you shop from the ads or by telephone. In addition, there is the question of keyboard layout. Many offices

*One of these 21 machines may indeed turn out to be your best computer buy.*

have PCs and ATs in place, and people often must move from one machine to another. Not everyone will want to move up to the newer 101-key IBM Enhanced style keyboard with the function keys along the top (and the Ctrl key moved to where my little finger won't go). It would be nice to find a machine that offered a range of keyboard options in terms of layout, quality, and price.

The other critical area is floppy disk drives. Almost every machine we tested accepted the 3½-inch floppy disk drive we installed as a test of compatibility and flexibility. As more and more PCs with micro-floppy disk drives hit the desks, it will become increasingly useful to have a machine with both 5¼-inch and 3½-inch drives available. Eventually, many users may need only the 3½-inch drive. The à la carte approach of many vendors will permit you to add one of the small drives (or insert it in place of the 1.2MB 5¼-inch floppy disk drive) for a small additional cost.

Reviews of 21 inexpensive AT-compatibles follow. The price tags of these configured systems, from a low of \$1,199 to a high of \$2,030, should entice you to

browse. Within this price range, you'll find some 12-MHz machines, some 40MB hard disks, even a free EGA display adapter. One of these machines may indeed turn out to be your best computer buy.

—Alfred Poor

### ALPHANUMERIC INTERNATIONAL INC.

#### ANI 8T

Where do they get these names? Some computer clones go for cute or catchy names, others for descriptive names, and still others for what can be most generously described as utilitarian names. Alphnumeric International has a name that appears to say almost nothing about the product: 8T. Nothing, that is, until you say it out loud and discover that it is yet another attempt to dodge the pin-striped legal eagles from Big Blue.

Hiding behind this cryptic moniker is a rather typical low-cost AT machine. It comes with eight slots: two 8-bit and six 16-bit. It offers five half-height disk bays, three of which can be reached through holes in the front of the case. The evaluation unit came with a Western Digital controller and a Seagate hard disk. There was even an extra I/O card with a serial port, and a pigtail adapter so that a 25-pin cable could be easily plugged into the 9-pin serial socket.

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**COMPONENT DESIGN** The Maxi-Switch keyboard and Princeton MAX-12 monochrome monitor were probably my favorite components in the system. The IBM Enhanced-style keyboard comes with extra keycaps for the Ctrl and CapsLock keys, but with the legends reversed. There is a switch on the underside of the keyboard that permits you to switch the assignments of these two keys, making for a far more comfortable layout from my perspective (Ctrl belongs above the Left Shift, not below it). The keyboard is also XT/AT switchable.

Fit and finish were acceptable aside

**FACT FILE**

**ANI 8T**  
Alphanumeric International Inc.  
13360 E. Firestone Blvd.  
Santa Fe Springs, CA 90670  
(213) 921-8689

**List Price:** Basic system with 640K RAM, 1.2MB floppy disk drive, \$949; with DOS, monochrome monitor and card, 20MB hard disk, \$1,499; with 40MB hard disk, \$1,699; with EGA monitor and card, 20MB hard disk, \$1,999; EGA system with 40MB hard disk, \$2,199.

**In Short:** The 8T presents a below-average value owing in part to its poor documentation, although its keyboard and expansion capabilities do give it some verisimilitude.

DISCLOSURE: IN A READER SERVICE CARD



cause they come with well-written instruction manuals filled with clear illustrations, backed up by a knowledgeable and accessible support staff. On the other hand, one computer arrived with less than 2 ounces of documentation, which literally does not say much for the product.

**SERVICE** Nearly every machine covered here comes with a 12-month warranty covering parts and labor, which should give you some reassurance, especially if you are shopping by phone. In most cases you'll be required to send the computer back to the company for warranty service, but most companies split the shipping; you pay to send it to them and they pay to send it back. Watch out, because a few have different policies: either the company pays both ways (nice) or you pay both ways (not so nice). The Oriental Precision Co., manufacturer of the OPC-286, offers local depot service through national service companies.

Warranty service is fine, but the company has to stick around to honor the warranty. Many of these mail-order firms can be characterized as small operations, and there is a clear and present danger that some will drift off in the night as quietly as they came. But if the computer is built with standard components, you should be able to get service from any local hardware service company.

Standard components means items such as the Western Digital WA2 combination hard/floppy controller; Phoenix, Award, or Eden ROM BIOS; and a motherboard based on the Chips and Technologies AT chip set. Other items such as display adapters and I/O boards cost too little to bother repairing at all; you are better off just buying a replacement. If your machine uses a proprietary controller or BIOS, however, you may find it more difficult to get service.

**CAVEAT READER** As you are discovering how these 21 computers measure up in the reviews that follow, there are a number of important points to keep in mind. First, we asked each company to send one computer, configured with a monochrome monitor and some kind of hard disk, a complete system priced as close to \$1,500 as possible. In every case, we had hoped to

get the very least expensive machine available from the company, but in some cases the company chose to send a slightly more expensive model that they hoped would perform better, because of a faster clock speed or higher-quality hard disk.

Most companies produce these computers à la carte rather than from a small list of preset configurations. You want a hard disk? Fine: 20, 30, 40MB or larger? You want a 40MB drive? Fine: do you want 65-, 40-, or 28-millisecond perfor-

*Almost every computer  
we tested arrived  
with DOS installed  
on its hard disk,  
but only six came with  
any kind of DOS  
documentation or disks.*

mance? Do you want 512K, 640K, or 1MB of RAM? Do you want the "house brand" BIOS or Phoenix? Do you want a monochrome display adapter, monochrome graphics, CGA, or EGA? Small or standard case? Original AT-style keyboard or the new IBM Enhanced style? With 6-, 8-, 10-, or 12-MHz performance? Almost all the companies offer one or more of these choices, which means that they offer dozens of different configurations, many of which rely on different motherboards. So, don't take our descriptions as the ultimate word on what these companies offer.

Similarly, don't count too much on the brand names of some of the components. For example, you may order a machine and find that where we got a Fujitsu floppy disk drive, you get a TEAC. Such interchangeable components can vary with fluctuating prices and altering design specs.

PC Labs evaluated two computers that came with Everex disk controllers, and by the time that the reviews were finished, both companies—Vector and Wall Street Computers—were shipping their ma-

chines with Western Digital controllers.

Finally, you should realize that prices in this market are anything but stable. Our Fact Files and features table represent what is best considered a snapshot of the market as it looked in late 1987. Given the state of the world economy and the performance of the dollar against foreign currencies, the only statement we can make for certain is that not all of these prices will still be valid when you read this. Don't read a review and then write out a check based on the Fact File. Instead, treat these figures as points of comparison; they tell you who is more or less expensive than the competition (but even that can change).

To help you compare apples with apples, our features table lists four different prices: the base system price (at least 512K RAM and one 1.2MB floppy disk drive), the monochrome system price (including monitor, display adapter, and hard disk), the EGA system price, and the tested configuration price.

**DEALING WITH DOS** Don't expect DOS to come automatically; it is not always part of a system's base price. Some shoppers may not realize that they need to pay the extra \$80 to \$120 for the operating system before they can bring the machine to life.

Almost every computer we tested arrived with DOS installed on its hard disk, but only six came with any kind of DOS documentation or disks. In almost every case (with one notable exception), the company representatives explained that this was done for our convenience, and that they never install DOS on the hard disk unless it is purchased at the same time by the buyer. If a company provides an unlicensed and undocumented copy of DOS, this is not only illegal, it is also a disservice to the buyer, who is stranded without the support documentation necessary to make DOS work.

According to a Microsoft representative, such a practice would be in direct violation of copyright laws. The irony is that it costs so little to buy the right to distribute MS-DOS as part of a system. The cost varies with the number of systems sold but typically should be about \$25 or \$30 per machine. Even in the cutthroat business of low-end marketing, this additional 2 per-



## ■ LOW-COST ATs

cent of the purchase price of a \$1,500 AT should be an affordable cost for a manufacturer to bear.

**HARDWARE DECISIONS** You should consider two additional factors as you shop.

The first is keyboards. The ones supplied with these machines were uniformly poor. In most cases they had no tactile response, and it is no fun to spend hours a day working at a mushy keyboard. Unfortunately, this is something you simply can't judge when you shop from the ads or by telephone. In addition, there is the question of keyboard layout. Many offices

*One of these 21  
machines may indeed  
turn out to be your  
best computer buy.*

have PCs and ATs in place, and people often must move from one machine to another. Not everyone will want to move up to the newer 101-key IBM Enhanced style keyboard with the function keys along the top (and the Ctrl key moved to where my little finger won't go). It would be nice to find a machine that offered a range of keyboard options in terms of layout, quality, and price.

The other critical area is floppy disk drives. Almost every machine we tested accepted the 3½-inch floppy disk drive we installed as a test of compatibility and flexibility. As more and more PCs with micro-floppy disk drives hit the desks, it will become increasingly useful to have a machine with both 5¼-inch and 3½-inch drives available. Eventually, many users may need only the 3½-inch drive. The à la carte approach of many vendors will permit you to add one of the small drives (or insert it in place of the 1.2MB 5¼-inch floppy disk drive) for a small additional cost.

Reviews of 21 inexpensive AT-compatibles follow. The price tags of these configured systems, from a low of \$1,199 to a high of \$2,030, should entice you to

browse. Within this price range, you'll find some 12-MHz machines, some 40MB hard disks, even a free EGA display adapter. One of these machines may indeed turn out to be your best computer buy.

—Alfred Poor

### ALPHANUMERIC INTERNATIONAL INC.

#### ANI 8T

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### FACT FILE

#### ANI 8T

Alphnumeric International Inc.  
13360 E. Firestone Blvd.  
Suite Fe Springs, CA 90670  
(213) 921-8689

List Price: Basic system with 640K RAM, 1.2MB floppy disk drive, 5949; with DOS, monochrome monitor and card, 20MB hard disk, \$1,499; with 40MB hard disk, \$1,699; with EGA monitor and card, 20MB hard disk, \$1,999; EGA system with 40MB hard disk, \$2,199.

In Short: The 8T presents a below-average value owing in part to its poor documentation, although its keyboard and expansion capabilities do give it some versatility.

CIRCLE 66 ON READER SERVICE CARD



## ■ LOW-COST ATs



*The AT 8T looks very much like other standard AT compatibles. It has eight expansion slots (six 16-bit and two 8-bit) and five half-height drive bays, three of which are accessible from the front. Its \$1,499 price for a system including 20MB hard disk and monochrome monitor is good, but it's not the kind of rock-bottom bargain that some of the other systems represent.*



from one glaring design flaw in the main case itself. The leftmost cutout in the back was adjacent to a rounded corner on the outside of the case. While this curved area may have aesthetic appeal, it prevented inserting our parallel cable connector into the 25-pin connector on the bottom of the display adapter card in that slot. Moving the card to an interior slot solved the problem, but the case design is flawed in a way that could cause some real frustration.

The hard disk came formatted with MS-

DOS 3.21 already installed, but there was no DOS documentation or distribution disks. When asked about this, an Alphnumeric International representative explained that the normal procedure is to perform a low-level format only; DOS is included if the buyer chooses to pay for the option.

**PERFORMANCE** The 8T performed on a par with other machines in its class. The only problem was its initial inability to run

a beta version of OS/2, a matter I was able to resolve after finding out from Alphnumeric's support staff which undocumented configuration changes had to be made to the motherboard jumpers.

One bright note in the 8T's favor is that besides providing the standard 1-year parts-and-labor warranty, Alphnumeric will pay shipping in both directions for warranty repairs.

With a respectable but not amazing price tag of \$1,499 for a monochrome system with a 20MB hard disk (\$1,699 with a 40MB hard disk), the 8T rates slightly below average in relation to the rest of the pack in terms of total value. You can probably do better. —Alfred Poor

### ALTEC TECHNOLOGY CORP.

#### Altec-286

Take an 80286, a pair of Phoenix ROM chips, 512K RAM, and a Western Digital combination controller, and dump them inside a chassis. Shake, let stand until settled, and you have your basic AT clone. In short, you have the Altec-286.

The Altec-286 does go beyond the bare minimums in some respects. For example, it comes with both a CPU speed switch and a hardware reset button. The documentation is supplied in a handsome linen-wrapped binder with matching slipcase. The chassis has cutouts in the back to mount those extra port connectors that



### FACT FILE

#### Altec-286

Altec Technology Corp.  
5751 Rockenbacker Rd.  
Los Angeles, CA 90040  
(800) 255-9971  
(213) 888-9100

**List Price:** Basic system with 512K RAM, 1.2MB floppy disk drive, \$975; with DOS, monochrome monitor and card, 20MB hard disk, \$1,495; with 40MB hard disk, \$1,695; EGA system with 20MB hard disk, \$1,795; EGA system with 40MB hard disk, \$1,995.

**In Short:** The Altec-286 plays hard and fast and is not your basic AT clone. It has the 12-MHz speed that you may want, but not the kind of documentation you may need. This one is a bargain for the self-reliant.

CIRCLE 107 ON READER SERVICE CARD



## ■ LOW-COST ATs



### Low-Cost ATs: Summary of Features

The 21 inexpensive AT compatibles reviewed in this roundup are listed in ascending price order based on the cost of a system configured with at least 512K RAM, a monochrome monitor and card, and a hard disk. The size of the hard disk

	Mitro 1 286 Plus	Lucky Star GS1-2000	Bentley 286/8	OPC-286	SCSI 286/10	Wall Street Computers Maxima
Base price	\$649	\$695	\$799	\$965	\$985	\$949
<b>Base price includes</b>						
RAM	640K	1MB	512K	512K	512K	1MB
Floppy disk drives	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB
Hard disk	None	None	None	None	None	None
Clock/calendar	●	●	●	●	●	●
Software	Setup	Diagnostics	Fullback, setup	DOS, BASIC	None	None
Monitor	None	None	None	None	None	None
Ports	None	1 parallel	1 parallel	None	None	2 parallel, 2 serial
Slots	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 8 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit
Power supply (watts)	200	200	200	230	200	200
Reset switch	●	●	○	●	○	●
Keyboard style	Original AT	IBM Enhanced	IBM Enhanced	Original AT	Original AT	IBM Enhanced
Keyboard connection	Back	Back	Back	Back	Back	Back
Keyboard cable length (inches)	44	60	50	33	33	46
<b>Configuration prices</b>						
Price of monochrome system with at least 512K RAM, hard disk, and DOS	\$1,199 (20MB)	\$1,285 (20MB)	\$1,329 (20MB)	\$1,399 (20MB)	\$1,420 (20MB)	\$1,474 (20MB)
Price of EGA system	\$1,549 (20MB)	\$1,685 (20MB)	\$1,669 (20MB)	N/A <sup>1</sup>	\$1,710 (20MB)	\$1,849 (20MB)
<b>Configuration tested</b>						
Price	\$1,199	\$1,285	\$1,329	\$1,399	\$1,420	\$1,624
Configuration	20MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	30MB hard disk, monochrome monitor
<b>Specifications</b>						
Clock speed (MHz)	6/10	6/10	6/8	6/8	10	6/10
Controller card handles	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives
<b>Other</b>						
Alternative floppy drive available	○	○	○	○	○	○
Warranty	1 year	1 year	1 year	1 year	1 year parts, 6 months labor	1 year
BIOS manufacturer	Phoenix	Award	Phoenix	Intech	American Megatrends	Micronix
OS/2 boot capability	●	●	●	○	○	○
Successful 3½-inch drive installation	●	●	●	●	●	●
FCC certification class	B	B	B	B	B	B

—Indicates Editor's Choice ●—Yes ○—No N/A<sup>1</sup>—Not applicable: OPC plans to release an EGA configuration.



included is listed to the right of the price. The EGA system price reflects simply the cost of choosing an EGA monitor and card rather than a monochrome monitor and card. In most cases, the tested configuration was the same as the basic monochrome system, and the prices are

identical. A few computers, however, came to PC Labs with either a little more or a little less configured in; these differences are reflected in the tested-configuration prices.

In the last four columns are the features of the four machines mentioned in

"Heard on the Street": the Tandy 1000 TX, the AST Premium/286, the Epson Equity III Plus, and the NEC APC IV PowerMate 2. The prices listed in the table for these machines are retail. To see how low their discounts can go, check the Fact Files within the story.

	Altec-286	PC Craft 286-C	AMI 8T	CompuAdd Standard 286-10	Logic ATC 286	Micro Lab AT-286
<b>Base price</b>	\$975	\$1,095	\$949	\$995	\$1,584	\$999
<b>Base price includes</b>						
<b>RAM</b>	512K	512K	640K	512K	1MB	512K
<b>Floppy disk drives</b>	One 1.2MB, one 360K	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB
<b>Hard disk</b>	None	None	None	None	20MB	None
<b>Clock/calendar</b>	●	●	●	●	●	●
<b>Software</b>	None	None	None	Fullback, setup, Disk Manager	DOS, setup, shareware	DOS, BASIC
<b>Monitor</b>	None	None	None	None	Monochrome	None
<b>Ports</b>	1 parallel	1 parallel, 1 serial	2 parallel, 2 serial	1 parallel	2 parallel, 2 serial	1 parallel, 1 serial
<b>Slots</b>	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	5 16-bit, 2 8-bit	6 16-bit, 2 8-bit
<b>Power supply (watts)</b>	220	200	200	200	200	200
<b>Reset switch</b>	●	○	○	●	●	●
<b>Keyboard style</b>	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	Proprietary
<b>Keyboard connection</b>	Back	Back	Back	Back	Back	Back
<b>Keyboard cable length (inches)</b>	42	48	44	50	44	42
<b>Configuration prices</b>						
<b>Price of monochrome system with at least 512K RAM, hard disk, and DOS</b>	\$1,495 (20MB)	\$1,495 (20MB)	\$1,499 (20MB)	\$1,529 (20MB)	\$1,584 (20MB)	\$1,599 (40MB)
<b>Price of EGA system</b>	\$1,795 (20MB)	\$1,950 (20MB)	\$1,999 (20MB)	\$1,868 (20MB)	\$2,083 (20MB)	\$1,999 (40MB)
<b>Configuration tested</b>						
<b>Price</b>	\$1,575	\$1,495	\$1,849	\$1,814	\$1,718	\$1,599
<b>Configuration</b>	20MB hard disk, second floppy drive, monochrome monitor	20MB hard disk, monochrome monitor	30MB hard disk, monochrome monitor	40MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	40MB hard disk, monochrome monitor
<b>Specifications</b>						
<b>Clock speed (MHz)</b>	8/12	8/10	8/10	6/10	6/10	6/10
<b>Controller card handles</b>	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives
<b>Other</b>						
<b>Alternative floppy drive available</b>	○	○	○	○	○	○
<b>Warranty</b>	1 year	1 year	1 year	1 year	9 months	1 year
<b>BIOS manufacturer</b>	Phoenix	Phoenix	Eden	Phoenix	Phoenix	Phoenix
<b>OS 2 boot capability</b>	●	●	○	●	○	●
<b>Successful 3½-inch drive installation</b>	●	●	●	●	●	●
<b>FCC certification class</b>	B	A	B	B	B	B

(continues)



Your prayers have been answered.

Now you can buy an affordable PC compatible from a company that will give you real PC of mind. Hyundai. The \$14 billion Korean giant that's one of the world's largest corporations.

A Hyundai computer is more than just a safe buy. It's a smart buy. Because you get more for your bucks than a box. Witness Hyundai's XT Turbo—

the 8.0 Mhz Super-16T.

It sports all the standard features you want. Like 640K of RAM. Six expansion slots. Serial and parallel ports. A real-time clock with battery backup.

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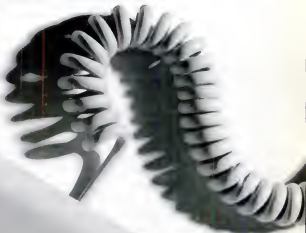
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# h Seoul.

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Software Corporation, XT/IBM  
International Business Machines  
Corporation



## ■ LOW-COST ATs



### Low-Cost ATs: Summary of Features

(continued)

	Vector 286	Northgate 286/12 ET	786 Stanford Systems 18	CCI 8T/286	PC's Limited 286-6	AMT286
<b>Base price</b>	\$1,175	\$1,667	\$1,049	\$1,595	\$1,249	\$950
<b>Base price includes</b>						
<b>RAM</b>	640K	640K	1MB	1MB	640K	640K
<b>Floppy disk drives</b>	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB
<b>Hard disk</b>	None	32MB	None	20MB	None	None
<b>Clock/calendar</b>	●	●	●	●	●	●
<b>Software</b>	Disk Manager, utilities	DOS, BASIC, utilities	None	Disk Manager	Setup	None
<b>Monitor</b>	None	Monochrome	None	None	None	None
<b>Ports</b>	None	1 parallel, 1 serial	1 parallel, 1 serial, 1 game	1 parallel	1 parallel, 2 serial, 1 game	2 parallel, 1 serial
<b>Slots</b>	4 16-bit, 4 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit
<b>Power supply (watts)</b>	200	220	180	200	192	220
<b>Reset switch</b>	●	○	●	●	○	○
<b>Keyboard style</b>	IBM Enhanced	IBM Enhanced	Proprietary	IBM Enhanced	IBM Enhanced	IBM Enhanced
<b>Keyboard connection</b>	Back	Back	Back	Back	Back	Back
<b>Keyboard cable length (inches)</b>	50	48	76	43	68	48
<b>Configuration prices</b>						
<b>Price of monochrome system with at least 512K RAM, hard disk, and DOS</b>	\$1,670 (30MB)	\$1,667 (32MB)	\$1,700 (20MB)	\$1,715 (20MB)	\$1,799 (20MB)	\$1,670 (42MB)
<b>Price of EGA system</b>	\$1,970 (30MB)	\$2,162 (32MB)	\$2,102 (20MB)	\$2,215 (20MB)	\$2,299 (20MB)	\$2,290 (42MB)
<b>Configuration tested</b>						
<b>Price</b>	\$1,670	\$1,786 (32MB)	\$1,700	\$1,895	\$1,799	\$1,670
<b>Configuration</b>	30MB hard disk, monochrome monitor	32MB hard disk, second floppy drive, monochrome monitor	20MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	42MB hard disk, monochrome monitor
<b>Specifications</b>						
<b>Clock speed (MHz)</b>	6/10	6/12	6/10	6/10	6/8	6/10
<b>Controller card handles</b>	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives
<b>Other</b>						
<b>Alternative floppy drive available</b>	○	●	○	○	○	○
<b>Warranty</b>	1 year	1 year	1 year	1 year	1 year	1 year
<b>BIOS manufacturer</b>	Award	Award	Award	Phoenix	PC's Limited	Eden
<b>OS/2 boot capability</b>	●	●	●	●	○	○
<b>Successful 3 1/2-inch drive installation</b>	●	●	●	●	○	●
<b>FCC certification class</b>	B	B	B	B	B	B

PC—Indicates Editor's Choice ●—Yes ○—No NA—Not applicable; NEC does not offer a monochrome monitor. NA?—Not applicable; Epson does not supply an EGA monitor.



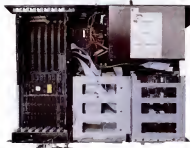
	Proteus 286F	PC Designs GV-601	47th Street Computer Mazum 286 Turbo 10	Tandy 1000 TX	AST Premium 286	Epson Equity III Plus	NEC APC IV PowerMate 2
Base price	\$1,495	\$1,200	\$1,149	\$1,199	\$1,995	\$2,295	\$2,595
<b>Base price includes</b>							
RAM	512K	1MB	640K	640K	640K	640K	640K
Floppy disk drives	One 1.2MB	One 1.2MB	One 1.2MB	One 720K 3 1/2-inch	One 1.2MB	One 1.2MB	One 1.2MB
Hard disk	None	None	None	None	None	None	None
Clock/calendar	●	●	●	●	●	●	●
Software	Little Black Book	None	DOS, BASIC, setup	DOS, BASIC, Personal DeskMate 2	DOS, BASIC	DOS, BASIC, X-Tree	DOS, BASIC
Monitor	None	None	None	None	None	None	None
Ports	1 parallel, 1 serial	1 parallel, 1 serial	None	1 parallel, 1 serial	1 parallel, 1 serial	1 parallel, 1 serial	1 parallel, 1 serial
Slots	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	5 8-bit	5 16-bit, 2 8-bit	6 16-bit, 3 8-bit	6 16-bit, 2 8-bit
Power supply (watts)	195	200	200	67	200	192	200
Reset switch	●	○	○	○	●	●	●
Keyboard style	Original AT	IBM Enhanced	IBM Enhanced	Proprietary	IBM Enhanced	IBM Enhanced	IBM Enhanced
Keyboard connection	Back	Back	Back	Back	Back	Back	Back
Keyboard cable length (inches)	36	36	34	Not tested	Not tested	Not tested	Not tested
<b>Configuration prices</b>							
Price of monochrome system with at least 512K RAM, hard disk, and DOS	\$1,995 (20MB)	\$2,014 (20MB)	\$2,030 (42MB)	\$2,128 (20MB)	\$2,995 (20MB)	\$3,495 (40MB)	N/A*
Price of EGA system	\$2,395 (20MB)	\$2,583 (20MB)	\$2,437 (42MB)	\$2,898 (20MB)	\$3,495 (20MB)	N/A†	\$5,420 (20MB) with Multisync monitor
<b>Configuration tested</b>							
Price	\$1,995	\$2,014	\$2,030	Not tested	Not tested	Not tested	Not tested
Configuration	20MB hard disk, monochrome monitor	20MB hard disk, monochrome monitor	42MB hard disk, monochrome monitor	Not tested	Not tested	Not tested	Not tested
<b>Specifications</b>							
Clock speed (MHz)	8/10	6/8	6/10	4/8	6/8/10	8/10/12	8/10
Controller card handles	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives	Two hard disks and two floppy disk drives
<b>Other</b>							
Alternative floppy drive available	○	●	○	○	○	●	○
Warranty	15 months	1 year	1 year	90 days	1 year	1 year	1 year
BIOS manufacturer	American Megatrends	American Megatrends	Eden	Phoenix	Phoenix	Epson	Phoenix
OS/2 boot capability	○	○	●	Not tested	Not tested	Not tested	Not tested
Successful 3 1/2-inch drive installation	●	●	●	Not tested	Not tested	Not tested	Not tested
FCC certification class	B	A	B	B	B	B	B



## ■ LOW-COST ATs



*The S975 Altex-286 is one of only two 12-MHz AT compatibles we reviewed. The machine sports a few extras to make it stand out in the crowd, including a reset switch, a CPU speed switch, and cutouts in the back of the unit to mount extra port connectors. A monochrome system with 20MB hard disk is priced at \$1,495.*



hang off expansion cards, otherwise left to dangle from the ends of ribbon cables. There is even a keyboard key sequence that toggles the computer's speaker on and off in case you want to practice silent running.

As one of only two computers in this group running at 12 MHz, the Altex-286 turned in some of the best performance times of all the machines tested. It passed the DOS 2.0 and OS/2 compatibility tests (although I needed help in reconfiguring

the motherboard jumpers to get the Intel Above Board to work). It worked with the 3½-inch disk drive I installed. In short, it ran fine. What more can there be?

**DUBIOUS DOCUMENTATION** Unfortunately, there could be lots more, as is evidenced by all that is missing. To start with, a thin, 85-page booklet makes the manual's 1½-inch binder look cavernous. Apparently the booklet was published for other purposes: its paperback cover was

torn off and three holes were punched in it then inserted in the binder. Most of its contents consist of copious listings of bus pin-out assignments and configuration settings.

There is some narrative content in the manual, although it is of dubious value. I present for your consideration the following excerpt verbatim, unmodified except that the original was set in a light, compressed, all-capitals typeface:

### (4) RESET (J24)

This pin can connect a push switch for reset. This reset function is hardware reset, when switch push on then system will be reset one time. Please note: when software reset is out of function (system hang), this function still workable.

**\*\*Remark:** Please be careful about this switch better put at fear part. of computer, don't touch it when it unnecessary.

While it is possible for a knowledgeable user to decipher this message, such a feat is more work than anyone should have to do. References to "match coprocessors," "FCC Regulation," and "turbo shooting" may also confuse. There is a large section on the keyboard's macro keys for writing BASIC programs, but I was not able to get them to work at all. The task was complicated by the fact that while the computer came with the hard disk formatted and MS-DOS 3.21 installed, there was no DOS documentation or DOS or BASIC disks.

**POLICY AND PERFORMANCE** When asked about the presence of DOS on the system without the distribution disks or documentation, an Altex representative said that units shipped for sale have a low-level format performed on the hard disk, and DOS is included only if the buyer pays for it as an option.

Altex has a 1-year parts-and-labor warranty and, like most of the competition, expects you to pay the shipping when you send the unit back for warranty repairs. Altex pays the return freight.

The Altex-286 ran reliably during our tests. It comes with a \$1,495 fully configured price, aggressively low for this level



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- Job Cost
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- NEW Reversing journal entries

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Requires PC/MS-DOS version 2.0 or higher with 5Mk of usable memory with a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal Systems/2™ and compatible 3½" media optionally available. IBM is a registered trademark and Personal Systems/2 is a trademark of International Business Machines. Not copy protected.

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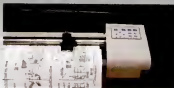
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CIRCLE 178 ON READER SERVICE CARD



## ■ LOW-COST ATs

of performance. Based on the support documentation, however, this machine is strictly for those users who are at ease with trouble-shooting in the dark and willing to take a gamble on a machine that meets you less than halfway. If you can accept that risk, the Altec-286 may offer an attractive option. —Alfred Poor

### AMERICAN MICRO TECHNOLOGY CORP.

#### AMT286

The AMT286 is a 286 machine made by American Micro Technology Corp. No surprises there. The surprises (some nice and some not so nice) were inside the computer. First a brief description.

The standard configuration of the AMT286 includes an 80286 processor running at a switchable 6/10MHz, 640K RAM and one 1.2MB Fuji half-height floppy disk drive are also standard. The power supply is rated at 220 watts and will handle up to four devices. Besides the floppy disk drive, our evaluation unit also had a 42MB Priam hard disk. There is room for two additional externally accessible half-height devices. The disks in the evaluation machine were controlled by a National Computer controller, but I was told that a normal installation would include a Western Digital controller. An extra ATD serial/parallel port card is also available, as is an AVT America 12-inch monochrome monitor with a tilt-and-swivel attachment. Although COMMAND.COM was installed on the hard disk, DOS is not automatically included in the pack-



*The AMT286 we tested included a 42MB Priam hard disk that boosted the machine's price to \$1,870. A stripped-down basic system will cost \$950. The 10-MHz processor performed more slowly than most of the others that were benchmarked, and the interior of the machine was more cluttered and disorganized than it should have been.*



age. This monochrome system sells for \$1,870, which seems a bit expensive compared with other AT compatibles—even considering the large size of the Priam disk. If you want bare bones you can spend \$950 and get the same system minus the monitor, card, hard disk, and DOS.

**PERKS AND SURPRISES** Now for the perks. When you buy an AMT286, you automatically receive a bright red plastic

AMT letter opener. Yet another "free gift" awaits you inside the package containing the system's documentation: a diskette containing public-domain utilities. These generated a wave of enthusiasm in our PC Labs on a par with the letter opener—useful but not very stimulating. Also included was an alarm clock that I set for noon (it went off successfully but was barely audible) and a calendar program that displays any month of any year.



### FACT FILE

#### AMT286

American Micro Technology Corp.  
14751 Ben Franklin Ave.  
Tustin, CA 92680  
(714) 731-6800

**List Price:** Basic system with 640K RAM, 1.2MB floppy disk drive, \$950; monochrome monitor and card, \$180; EGA monitor and card, \$600; 42MB hard disk, \$650.

**In Short:** The AMT286 has a great price tag, but performance falls below that of most of the other 10-MHz AT compatibles.

CIRCLE 66 ON READER SERVICE CARD



## ■ LOW-COST ATs

Then the not-so-nice surprises began to pop up. The RAMTEST program hung the machine. Whether the program or the AMT286 was the problem, I couldn't clearly determine, but it was not confidence-inspiring. The Ctrl-Alt-Del reset didn't work, but turning the machine off and on resurrected the DOS prompt. Running Setup gave us pause as well. The Setup screen appeared with the system configuration. When anything was changed and this configuration screen was refreshed, graphic characters appeared on the line reporting the number of diskette drives. "1.2 MB" appeared on the line for showing the time, and the drive type appeared on the line for displaying the date. Again it wasn't a crisis, but when the obvious is overlooked. . . .

So I opened up the CPU to take a look at the less obvious, and more problems appeared. Inside the machine was a crowded nest of short, loosely connected cables, and the drive connectors were not keyed.

**PERFORMANCE AND POLICIES** The machine yielded some of the slower times in benchmark testing: it was among the slowest of all the 10-MHz machines when tested for CPU speed. It scored middle-of-the-road in memory access speed tests. The file access tests tended to divide the tested computers into two clumps on the spectrum: fast and slow. The AMT286 fell into the slow group on sequential file manipulation and into the fast group on random file access.

Once installed (with more fuss than should have been necessary because of the short length of cable supplied), a 3½-inch floppy disk drive worked fine. I tried to install OS/2 but could not get it to boot. An AMT representative said that a new BIOS that will handle the beta version of OS/2 is being installed now and is available to current owners.

The warranty that comes with the standard package lasts 1 year and covers parts and labor for the motherboard, power supply, and keyboard. Other parts are covered for 90 days. When you need the machine serviced, you have to ship it to California. There is also a customer-support line for your questions, but it is not toll free.

The documentation consists of the various owner/user manuals for the different

components and is all pretty basic.

My overall impression is that AMT has attempted to use cosmetic perks to entice the unsophisticated user, and that such a user is going to get nervous when up against the little quirks that lie waiting. Though getting electronic tools to help with miscellaneous tasks is a bonus, the central task of a computer is computing, and AMT should make an effort to clean up this area.—**Kate Emery**

## BENTLEY COMPUTER PRODUCTS

### Bentley 286/8

The Bentley is named after a car often referred to as "the poor man's Rolls Royce," known for its class despite a lower price. This computer wears the name well, since it balances low cost with solid performance. The 286/8 is not jam-packed with features; it has no speed switch, no motherboard I/O ports, no fancy gadgets. Its only embellishment is a fairly standard and utilitarian turbo-mode indicator on the front of the case.

**UNDER THE HOOD** The Bentley shows a distinctly conservative interior design. There is a downsized motherboard capable of holding 1MB of RAM (we got 512K in our evaluation unit). The motherboard also sports the familiar pair of Phoenix BIOS ROM chips, along with the reli-

able Chips & Technologies AT chip set. The standard Seagate hard disk was connected to a traditional Western Digital WA2 floppy/hard disk combination controller. A typical Taiwanese monochrome graphics card with parallel port rounded out the internal hardware.

The case is just a little narrower than the traditional IBM AT case, a reduction made possible by the smaller motherboard. The case holds only four half-height storage devices, and there are openings in the case for access to just two. This is fine, from one perspective, since the 200-watt power supply comes with only four power connectors. On the other hand, it means that users are limited to only two removable-media devices. In these days of 1.2MB and 360K 5¼-inch floppy disk drives, 3½-inch microfloppies, and various removable hard disk and tape backup units, this may be too constrictive for some users' mass-storage needs.

Another problem with the smaller size arises when you look at the half-length slots on the motherboard. The rightmost slot has a 16-bit socket, but you can only fit an 8-bit card in it because the cable connector on the hard disk sticks out over the edge connector, making 16-bit cards with the longer edge connector an impossible fit. This is a small drawback, however, since there are relatively few 16-bit half-length cards available.

**RUNNING THE MACHINE** The keyboard is an enhanced AT-style unit made by Unitek. It has a slightly mushy feel, and I did not like it as well as some of the others that provided more tactile feedback. The keyboard was also the source of the only problem I had with the machine. When I first went to boot it up, the power-supply fan went on but nothing happened. While walking through the troubleshooting procedures with the Bentley technical support staff, I discovered that the keyboard had been shipped with a switch set for operation with an XT-class machine. I moved that switch to the AT setting, and the machine ran fine. It would have been nice if the POST (power-on self-test) had been able to give a message diagnosing the problem, but at least it was an easy one to solve.

The diagnostic routines were far more



## FACT FILE

### Bentley 286/8

Bentley Computer Products

1700 Still Meadow Cove

Round Rock, TX 78681

(800) 331-6799

(800) 777-7003 (in Tex.)

List Price: Basic system with 512K RAM,

1.2MB floppy disk drive, \$799; with DOS,

monochrome monitor and card, 20MB hard

disk, \$1,329; with 40MB hard disk, \$1,529;

EGA system with 20MB hard disk, \$1,669;

EGA system with 40MB hard disk, \$1,919.

In Short: A solid machine that trades some expansion potential for a slightly smaller size, the Bentley 286/8 comes with good documentation and presents an acceptable value in this market.

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## ■ LOW-COST ATs



At \$1,329 for a monochrome system with a 20MB hard disk, the Bentley 286/8 is one of the least expensive machines in this group, but its slow 8-MHz performance may not be a worthwhile trade-off for the price break. A smaller-than-usual motherboard allows the machine to have a narrower footprint than most other AT compatibles.



effective when I tried to connect the 3½-inch floppy disk drive. The self-test mentioned that the configuration information in the CMOS (complementary metal oxide semiconductor) RAM did not match what the computer found, but the computer still went ahead and booted after giving that message. I found I was able to access the 3½-inch drive at that point, without having to reset the configuration.

**HANDBOOKS AND HARD DISK** The Bentley comes with sufficient documentation, including a handbook that appears to be written specifically for the computer. This alone sets it apart from many of the other machines. The Installation and Operations Handbook is well organized and full of clear illustrations, with about enough useful information to help most novice users set up the machine and get it running.

There are also less-helpful booklets for the Seagate hard disk and the monographics card.

Computers that are purchased with a hard disk also come with a bonus: Westlake Data's *Fullback*, a useful hard disk backup utility.

---

*At \$1,329, the Bentley 286/8 is one of the best values in this crop of clones.*

---

The hard disk came formatted and with MS-DOS 3.21 already installed, but there were no distribution disks or DOS documentation. A Bentley representative explained this lack by saying that the DOS installation was done just for the evaluation unit. Bentley does not install DOS on the hard disks of systems that they ship, and it supplies the DOS distribution disks and manuals for those buyers who choose to pay for the option.

With the price of a monochrome system including a 20MB hard disk set at \$1,329 (and stripped-down basic systems at \$799), the Bentley 286/8 is one of the best values in this crop of clones. It uses some of the most reliable and standard components yet provides a total package at an extremely competitive price. Like its namesake, it offers high-class quality at an affordable price.—**Alfred Poor**

## COMPUADD CORP. **CompuAdd Standard 286/10**

Surprises are great at a birthday party, but they are not nearly so much fun when you are shelling out more than a thousand of your hard-earned greenbacks for a computer. All the better, then, that the CompuAdd Standard 286/10 will probably bore you right into a state of bliss.

The word *standard* is truly appropriate here. Phoenix ROM BIOS; Western Digital WA2 floppy/hard disk controller; 512K RAM on a motherboard that accepts 1MB;



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## ■ LOW-COST ATs



*The CompuAdd Standard 286/10 offers the best combination of quality, performance, and price. The parts are all brand name, it is backed by a solid warranty and service system, and it is as compatible as any other AT clone. It ran a beta version of OS/2 flawlessly, and installation of a 3 1/2-inch disk drive was easily accomplished.*



full-size case; 200-watt power supply; even the ubiquitous Samsung amber-screen monitor. No surprises here.

And standard is as standard does. I had no problems at all with any of the compatibility tests I ran. The unit accepted the 3 1/2-inch floppy disk drive without complaint. It booted up under DOS 2.0 like a champ. It even took the Intel Above Board and OS/2 right in stride. No surprises.

It also has many of the standard extensions to the original AT design. It runs at a

peppy 10 MHz or a traditional 6 MHz. There is no keyboard speed toggle, but a switch on the back of the case offers easy selection at any time. The back of the case also sports a hardware reset switch, which can be a welcome feature when your CPU freezes.

The case offers bays for up to five half-height devices, which is one more than the number of power connectors available on the power supply. Only two of the bays are open to the front; this limits you to two de-

vices with removable media (such as tapes and floppy disks).

**SOME SURPRISES** The Standard 286/10 does harbor a few surprises, but most of them are good ones. Foremost is the documentation: there is plenty of it, and it is good. The main manual, prepared specifically for this computer, is written in clear English and is filled with clean illustrations on well-designed pages. Even a rank beginner should be able to get the monitor and power cords correctly connected and have the machine up and running without any outside help. There are lucid instructions on configuring the system, adding expansion cards, and troubleshooting potential problems.

There are also manuals for the free software that comes bundled with the system. This includes *Disk Manager*, from On-track Computer Systems, and *Fullback*, from Westlake Data Corp. Between these two programs, you can install and run diagnostics on your hard disks and back up their data onto floppies. Our evaluation unit also included manuals for both the monochrome graphics adapter and the high-performance 40MB Miniscribe hard disk that came with the system. (A less powerful 40MB Seagate hard disk is available at a lower price.)

The hard disk came formatted with MS-DOS 3.21, but no DOS documentation or

### EDITOR'S CHOICE FACT FILE

#### CompuAdd Standard 286/10

CompuAdd Corp.  
12303-G Technology Blvd.  
Austin, TX 78727  
(800) 531-5475  
(800) 666-1872 (in Tex.)

**List Price:** Basic system with 512K RAM, 1.2MB floppy disk drive, \$995; with DOS, monochrome monitor and card, 20 MB Seagate hard disk, \$1,529; with 40MB hard disk, \$1,628; EGA system with 20MB hard disk, \$1,868; EGA system with 40MB hard disk, \$1,968.

**In Short:** The Standard 286/10 is not flashy, but it's a solid performer and a good value. Its documentation makes it one of the few packages suitable for novices, and its 10-MHz speed will be sufficient for most users.

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## ■ LOW-COST ATs

distribution disks were supplied with the machine. Normally, at the base price, CompuAdd does not load DOS on the disk; it includes the DOS disks and documentation only if they are ordered by the buyer as an option.

**MINOR LAPSES** There are a few lapses in some areas. For example, the connector on the floppy disk controller is not keyed to fit the notch on the edge connector of a floppy disk drive. This means that a novice user adding a new drive could easily install the cable backwards. Also, the outer case was not well built. The holes for the machine screws did not line up properly, and an alignment stud from the front fell off when I tried to close the case. My only other complaint was that the power supply on the evaluation unit had a slight buzz and seemed noisier than some of the other units.

CompuAdd offers a 1-year parts-and-labor warranty, with the buyer paying to ship the computer back to Texas; the company pays return shipping. There is also a 30-day money-back guarantee.

The Standard 286/10's \$1,529 price (including monochrome monitor and 20MB hard disk) is not the lowest by any means, but you are more than adequately compensated by the machine's consistently high quality.

Overall, the Standard 286/10 appears to be one of the most attractive values of all the AT compatibles in this group. It comes with a good complement of manuals and software and performs precisely as you would expect. You should be happy with this one. —Alfred Poor

### COMPUTER CLASSIFIEDS INC.

#### CCI ST/286

When you see an incredibly low price for an AT compatible, you'll often find a minimal configuration to go with it. This is not the case with the CCI ST/286, Computer Classifieds' lowest-priced offering.

For \$1,595 you get a complete system based on Intel's 80286 microprocessor, operating at 10 MHz with one wait state. This includes a monochrome monitor, mono graphics/printer adapter card, clock/calendar, floppy/hard disk controller, a 1.2MB floppy disk drive, a 20MB



*The CCI ST/286 is one of the most solidly engineered AT-compatible machines on the market. Fit and finish are well above average and justifies its \$1,715 price (with monochrome monitor and 20MB hard disk). Options like additional high-speed RAM can turn this system into a real power performer.*



hard disk, and 1MB of parity-checked dynamic RAM on the motherboard. A full 640K is allocated to DOS and the remaining 384K to extended memory. The warranty period is 1 year.

**CONSTRUCTION** Not only does the CCI ST/286 give you a substantial complement of features for a small cash outlay, you also get a solidly constructed comput-

er. The case is sturdy with a nice external finish, the drive bays are well constructed, and boards fit easily yet firmly in the slots.

The 80286 processor, located to the left of the 200-watt power supply, is surrounded by a heat sink that should help extend its life-span. A vacant socket for an 80287 numeric coprocessor is nearby. The 10-MHz speed can be slowed down to 6 MHz by flipping a switch inconveniently located



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## ■ LOW-COST ATs

on the back of the system. (You'll find the hardware reset switch immediately below the 6/10-MHz switch.) There is no indication on the screen at boot-up or on the front panel of the case about the current processor speed. Although the motherboard can hook up to an LED indicator, the CCI ST/286 case doesn't allow for it.

If performance is your ultimate goal, you can order your system with 1MB of high-speed 100-nanosecond RAM for an additional \$125, allowing you to run your system with zero wait states.

The ST/286 uses the Phoenix BIOS and the Phoenix keyboard controller. A 64K Motorola CMOS (complementary metal oxide semiconductor) RAM chip contains the system clock and stores system configuration information. A utility run from DOS is used to set configuration data. Two lithium batteries—one attached to the power supply and one mounted on the motherboard to the side of the power supply—prevent loss of setup data and keep the clock going when the machine is off.

The standard AT-size case has room for three half-height-drive storage devices, which are accessible from the front panel, and one full-height storage device. A Toshiba 1.2MB 5¼-inch floppy disk drive and a 44MB Micropolis hard disk were included in the tested configuration.

Storage devices slide easily into the drive bay casings. I had no trouble installing a 3½-inch floppy disk drive, and once installed, the drive successfully formatted

and ran a microfloppy disk. Overall compatibility was excellent.

**FORMATTING FEATURES** The 44MB hard disk drive, rated at 28 milliseconds, tested out at 29.9 milliseconds. It came formatted from Computer Classifieds in an unusual manner—8K was partitioned as the C: drive and the remaining

### *The CCI ST/286*

*is a consistently  
solid performer and  
a good buy as well.*

43MB made up the D: drive. To get DOS to recognize more than 32MB on the D: drive, the hard disk was formatted with *Disk Manager* from Ontrack Computer Systems. While the boot partition is limited to the 32MB recognized by DOS, *Disk Manager's* device driver, DMDRVR.BIN, allows you to use larger nonbootable partitions. *Disk Manager* is included when you purchase a system with a 44MB (or larger) hard disk.

The system board has eight expansion slots: two 8-bit slots and six using the 16-bit data bus. Two boards are included as standard equipment. The Western Digital WD1002 floppy/hard disk combination controller occupies the 16-bit slot nearest the power supply. The 8-bit slot farthest from the power supply contains a mono graphics/printer adapter card with a 9-pin TTL video port and a 25-pin parallel printer port. Four cutouts—two for DB-25 connectors and two for DB-9 connectors—are located on the rear panel to accept the extra port connectors from expansion boards.

A 12-inch Samsung monochrome monitor on a tilt-and-swivel base is supplied with the system. An ant glare treated screen and near-black background make this monitor more than adequate.

The 101-key EECO MultiSwitch keyboard is patterned after IBM's Enhanced AT-style keyboard. Its keys have a good, springy over-center feel, although not so clicky as the IBM. I was favorably impressed with it.

Aside from a sparse manual that is a jumble of the technical and the elementary, the CCI ST/286 is a consistently solid performer, and its all-in-one price makes it a good buy as well.

—Catherine D. Miller

## DELL COMPUTER CORP. PC's Limited 286-8

PC's Limited is changing its image. No longer content to stay with the slim profit margins of mail order, the company is targeting the lucrative corporate buyers: companies that can buy 10, 20, or a 100 computers at a shot. In order to woo corporate America (and to market its machines internationally), it's hired some big guns, bolstered its product line, and emphasized its official identity as the Dell Computer Corp. But investing in a PC's Limited 286 can be risky business, and corporate buyers should take heed.

Contrary to Dell's advertising, the PC's Limited 286 we tested did not run OS/2. This may not be a problem for you now, since we're still in a DOS world, but what about next year? Microsoft has been diligent in its efforts to make OS/2 downward-compatible to 80286-based machines. But PC's Limited proprietary BIOS didn't support it. And if you have a laptop or PS/2 computer with 3½-inch drives, don't expect to upgrade the PC's Limited with a



## FACT FILE

### CCI ST/286

Computer Classifieds Inc.  
17830 State Road 9  
Miami, FL 33162  
(305) 651-5853

**List Price:** Basic system with 1MB RAM, 1.2MB floppy disk drive, 20MB hard disk, monochrome monitor and card, \$1,595; 44MB hard disk, \$300; 100-nanosecond RAM (running at zero wait states), \$125; EGA monitor and card, \$500.

**In Short:** A solidly constructed, fully configured 10-MHz AT compatible at a bargain price, the CCI ST/286 is also compatible with all the software tested on it.

CIRCLE 666 ON READER SERVICE CARD



## FACT FILE

### PC's Limited 286-8

Dell Computer Corp.  
1611 Headway Circle, Bldg. 3  
Austin, TX 78754  
(800) 426-5150  
(800) 252-8336 (in Tex.)

**List Price:** Basic system with 640K RAM, 1.2MB floppy disk drive, \$1,249; monochrome system with 20MB hard disk, \$1,799; monochrome system with 40MB hard disk, \$1,999; EGA system with 20MB hard disk, \$2,299; EGA system with 40MB hard disk, \$2,499.

**In Short:** A not-so-cheap, not-real-fast AT-class computer with some major BIOS incompatibilities. But the machine is well made, and Dell Computer backs up its product with a solid support staff.

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- \* AMI BIOS (w. set up software).
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- \* Hard & Floppy Drive Controller.
- \* Enhanced Capacity Keyboard (101 Keys).

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### Introducing . . .



## CPU 286/12

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- Phoenix BIOS
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#### CPU 286/10

- Same as above with 286-10 CPU, 0 wait state, SI: 11.5, 12MHz throughput; fixed bus wait state

### BASIC SYSTEM

The CPU 286/12 and CPU286/10 are configured as follows:

- 512K of 0 wait state RAM: CPU 286/12, 80ns; CPU 286/10, 100ns
- 1.2MB floppy drive
- Dual floppy/hard disk controller
- 101-key enhanced keyboard
- 8 expansion slots
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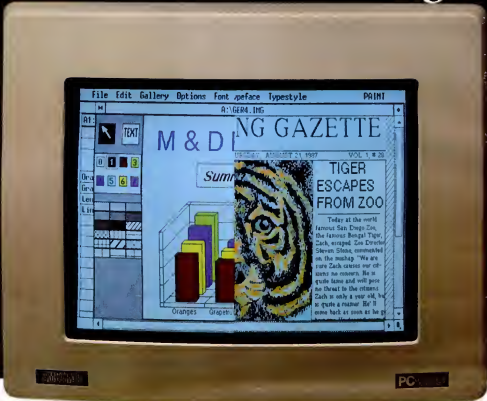


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## ■ LOW-COST ATs



The PC's Limited 286 machines are among the best-known inexpensive AT compatibles. This 8-MHz model is the cheapest in the line, and its performance was the slowest of all the machines tested. The \$1,799 system includes a monochrome monitor and 20MB hard disk, which puts it on the expensive side, especially for an 8-MHz machine.



matching drive; another BIOS incompatibility prevented us from installing an internal or external 3½-inch disk drive.

**DESIGN** The computer reviewed was a small-chassis machine with 1MB of memory on the motherboard. Future 286 shipments will have only 640K but can be expanded to a full megabyte on the motherboard. The 286-8 came with a Lapine LT2000 20MB hard disk and a 1.2MB floppy disk drive. The \$1,799 sys-

tem included a Magnavox amber monochrome monitor and a monochrome graphics adapter card with a parallel port. The monitor was adequate but obviously cheap. An additional I/O half-card gives you 2 serial ports, another parallel port, and a game port. The 101-key IBM Enhanced-style keyboard is made by Fujitsu and feels uncomfortably mushy to the touch.

The small-chassis model, which is 18½ inches wide, contains one drive cage with

room for up to three half-height drives. The large chassis (actually normal size) is 21 inches wide and has two drive cages, with room for one full-height and three half-height drives. The Western Digital controller card can operate two fixed and two floppy disk drives. Dell Computer includes a hard disk setup utility that lets you perform a variety of diagnostic tests, reset the interleave factor, and initiate a low-level format. The accompanying manual provides an excellent tutorial on how hard disks work.

The PC's Limited 286 series has six 16-bit expansion slots and two 8-bit slots. The chassis is well constructed and solid; I had no problem fitting boards into the expansion slots. DIP switches on the motherboard are set to choose between a color or a monochrome display and to indicate how much RAM there is installed on the motherboard. There's an open socket for an 80287 math coprocessor chip.

The machine reviewed had a clock speed of either 6 or 8 MHz, but models with faster speeds—up to 16 MHz—are available. In tests conducted in PC Labs, the PC's Limited 286-8 performed on a par with the 8-MHz IBM AT: acceptable, but certainly not exciting.

**EASE OF USE** Dell Computer sells you a computer that runs. If you buy a 286-8 with a hard disk, and you'd be crazy to buy one without it, it arrives already installed. With help from the manuals and documentation, even novice computer users can be up and running quickly. And if you have any problems, Dell Computer has toll-free technical support lines with knowledgeable, friendly folks at the other end. The warranty period is 1 year.

If Dell Computer wants to be successful selling into the *Fortune* 1000, it must correct the incompatibilities with OS/2 and the 3½-inch drive problem. It needs to remember that low-cost, compatible computers got it where it is today. There's an old saying in Texas, "You leave the dance with the one that brung ya." Without these fixes, we users may be left at the door. [Dell Computer reports that it is completing work on BIOS improvements that will allow the PC's Limited 286 series to run OS/2 and handle 3½-inch floppy disk drives.—Ed.]—Christopher Barr



## ■ LOW-COST ATs

### 47TH STREET COMPUTER

## 47th Street Computer Maxum 286 Turbo 10

47th Street Computer is one of the country's largest computer dealers. Its own line of hardware, called Maxum, consists of generic parts marketed with fairly aggressive pricing. The computer tested for this review, the Maxum 286 Turbo 10, is a dual-speed 6- and 10-MHz AT compatible that ran everything that was thrown at it.

The basic unit sports an 80286 processor running at 6 or 10 MHz, the speed being selectable from the IBM Enhanced-style keyboard. The motherboard can hold up to 1MB of memory using 256K chips, but stock machines come with 640K.

The computer's case looks like a normal IBM AT box. A Western Digital combination drive controller runs up to two floppy disk drives and two hard disks, with a single 1.2MB, high-capacity floppy disk drive included. The floppy disk drive on the test machine was a Fujitsu, but 47th Street Computer uses Toshiba drives as well.

Four storage devices will fit in the machine. Three of them can be accessed from the front panel for inserting and removing disks and tape cartridges. All four devices can be plugged into the standard 200 watt power supply. The Maxum 286 Turbo 10 tested came with the Eden ROM BIOS, Version 3.17. The system ran DOS 2.0,



*The 47th Street Computer Maxum 286 Turbo 10 is the quintessential high-quality mail- (or telephone-) order machine. Possible configurations are numerous, and the component parts all carry brand names (Seagate, Priam, Eden) that are familiar and should afford some peace of mind to the wary mail-order shopper.*



## FACT FILE

### 47th Street Computer Maxum 286 Turbo 10

47th Street Computer  
36 E. 19th St.  
New York, NY 10003  
(800) 221-7774  
(212) 398-1410

**List Price:** Basic system with 640K RAM, 1.2MB floppy disk drive, \$1,149; monochrome system with 42MB hard disk, \$2,030; EGA system with 42MB hard disk, \$2,437.

**In Short:** The Maxum 286 Turbo 10 is just what it's supposed to be: a generic AT compatible with a 10-MHz turbo mode. It works as it should and runs standard hardware and operating systems without a hitch.

CIRCLE 67 ON READER SERVICE CARD

DOS 3.2, and a beta version of OS/2 without a snag.

I was also able to add extended memory through a loaded Intel Above Board and install a 3½-inch microfloppy disk drive. The Turbo 10 recognized both additions and ran them flawlessly.

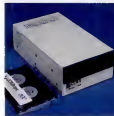
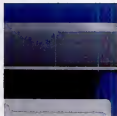
**PERFORMANCE** The performance figures for the Turbo 10 hold no surprises. The system scored right in the middle of

the other 10-MHz 286 machines, with no outstandingly high or low numbers. The hard disk test scores were better than most since the test machine came with a screaming Priam 42MB hard disk with a rated 29-millisecond access time.

While the parts are all there and everything performs as expected, the inside of the box is just a bit rough, with the edges of some of the metal parts cut but not finished. This is a minor point and has no ef-



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## ■ LOW-COST ATs

fect on value or performance.

The Turbo 10's documentation is pretty good, with a clearly illustrated 55-page owner's operation guide and manual. If you buy DOS with the machine (it is not included in the base price), you get MS-DOS 3.2 and GW-BASIC, with full Microsoft documentation. A ROM-based setup program comes with the machine and is accessible from the keyboard, so you don't have to restart the machine with a diagnostic and setup diskette.

**REPAIR POLICY AND PRICING** The Turbo 10 comes with a 1 year warranty, but there are no local service centers or service providers. If you have a problem, you have to pack up the hardware and send it to 47th Street Computer, along with your bill of sale, proof of purchase date, and an explanation of what's wrong.

The evaluation unit, with a monochrome monitor and the Priam 42MB hard disk, was priced at \$2,030. An EGA system with the same hard disk sells for \$2,437. The Turbo 10 is one of the few machines among these 21 competitors whose price tag stepped above the \$2,000 mark, but the excellent hard disk it comes with is the main reason why. Less expensive options are available.

The Turbo 10 is a fine-performing 10-MHz machine. Everything in it works, and it runs industry-standard parts from other vendors. It's a pain to have to mail hardware for service, but at least you have the comfort of dealing with a company that's known throughout the country.

—Bruce Brown

## LOGIX MICROCOMPUTER

### Logix ATC 286

This one is different. It is smaller than other machines in its class in a variety of ways. Some ways represent improvements, while others detract from the overall value.

The Logix ATC 286 has a slightly smaller footprint than the original AT. This is made possible in part by a smaller motherboard. It has the usual mix of 8-bit and 16-bit slots, with one difference: one slot is missing. It offers only seven slots (two 8-bit and five 16-bit) instead of the more common eight.



*With only seven expansion slots and two half-height disk drive bays, the Logix ATC 286 has slightly less expansion potential than most of its competitors. Its \$1,584 price places it in the middle of the pack of inexpensive AT compatibles. The trade-off for its smaller footprint is an inability to fill the machine with all the peripherals you may want.*



Surprisingly, none of the cards are half-length, in spite of the smaller case size. This is because the chassis offers only two half-height disk bays, not the more typical five or six. Both bays are open through the front of the case, but the bottom line is that this machine has extremely limited storage potential. One floppy disk drive and one hard disk are all that the chassis will accommodate.

There is another, more significant result of the smaller case size from a vertical

perspective. The case is lower than that of a standard AT, and is closer in size to an XT-height box. As a result, it shares a problem with that ever-popular IBM model, the XT-286, which cannot accept many 16-bit expansion cards because they are too tall to fit in the chassis. According to a Logix representative, a traditional full-size version of the ATC 286 is also available at the same price.

The height limitation means that Logix cannot use the normal Western Digital



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## Benchmark Tests: Low-Cost ATs

The 21 AT-compatible machines we tested break into three clearly delineated performance categories: the 8-MHz machines, the 10-MHz machines, and the 12-MHz machines. In our test group, only the Northgate 286/12 ET and the Altec-286 performed at a top speed of 12 MHz. Several other companies sell 12-MHz models, but we tested only the least expensive AT-compatible from each source, and in most cases a lower price tag means slower performance. Hard disk access speeds varied widely, with three of the best performers belonging to three of the better-known names in this market: CompuAdd, 47th Street Computer, and PC Designs.

Only one machine, the PC's Limited 286-8, had a BIOS that was incompatible with our benchmark tests; it therefore could not complete the disk access tests. This incompatibility does not indicate a problem with the disk drives themselves, but since the BIOS also does not allow the installation of a 3½-inch floppy disk drive, Dell Computer is currently working to rewrite it to more standard specifications.

### Performance Times

(Times given in seconds except where noted)

	NOP	80286 Instruction Mix	Floating-Point Calculation	Conventional Memory	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)
Northgate 286/12 ET	2.81	8.04	23.84	0.85	65.96	86.12
OPC-286	4.17	8.85	35.48	1.29	65.35	73.09
Bentley 286/8	4.17	8.97	28.12	0.90	65.33	72.92
Altec-286	2.69	5.72	22.68	0.82	65.25	72.92
Logix ATC 286	3.35	5.55	22.30	0.71	65.36	72.58
SCSI 286/10	3.35	7.09	27.96	1.02	65.32	71.51
786 Stanford Systems 286-10	3.35	5.55	22.24	0.77	63.94	71.50
Micro 1 286 Plus	3.35	7.09	27.95	1.04	65.08	71.35
PC Craft 286-C	3.35	7.09	28.01	1.01	60.78	68.49
Lucky Star GST-2900	3.35	5.55	22.25	0.71	61.03	67.73
Micro Lab AT-286	3.35	5.55	22.25	0.77	41.36	42.62
Vector 286	3.35	7.09	28.01	1.01	37.06	40.37
ANI 8T	3.35	7.20	28.45	1.04	42.71	37.83
Wall Street Computers Maxtime	3.35	5.55	22.24	0.74	42.62	37.26
8-MHz IBM PC AT	4.17	8.96	35.60	1.32	42.54	37.20
CompuAdd Standard 286/10	3.35	7.14	28.01	1.04	34.50	35.57
Proteus 286F	3.35	5.54	22.25	0.74	42.40	33.83
AMT286	3.35	7.19	28.45	1.01	31.64	30.26
CCI ST/286	3.35	7.06	28.02	1.01	45.80	29.86
47th St. Computer Maxum 286 Turbo 10	3.35	7.19	28.45	1.04	31.06	28.18
PC Designs GV-801	4.17	9.01	35.70	1.29	36.78	24.85
PC's Limited 286-8	4.23	8.79	35.45	1.28	N/A <sup>1</sup>	N/A <sup>1</sup>

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

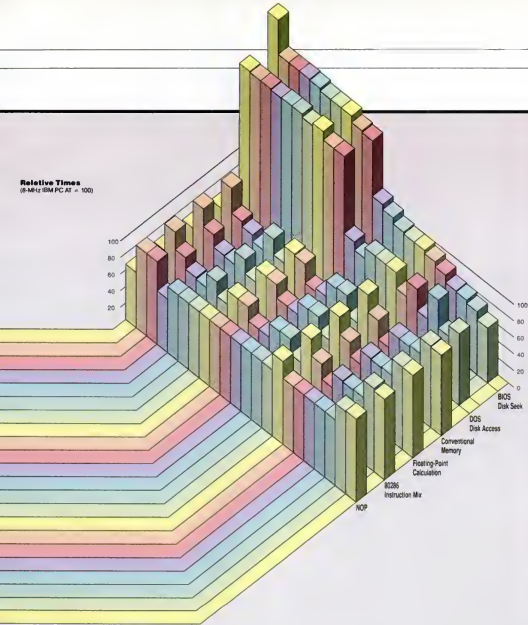
The 80286 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction codes. These instructions are a subset of the total processor instruction set.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

N/A<sup>1</sup>—Not applicable: Test could not be completed without errors. N/A<sup>2</sup>—Not applicable: BIOS incompatible with test.



**Relative Times**  
(8-MHz IBM PC AT = 100)



The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.



## ■ LOW-COST ATs

WA2 floppy/hard disk combination controller. Logix could have opted for separate hard and floppy controllers but did not, maybe because the unit is already short one slot. Instead, Logix uses a combination controller from National Computer Ltd. This is the only time I have ever encountered that device.

**PROBLEMS** I cannot say for certain that the controller caused the problems I had with some of the compatibility tests, but the computer did fail to read the OS/2 system disk. I even made a copy of the distribution disk using another computer, but the machine still failed to read it. I suspect the controller is the problem, because the computer uses the same Phoenix ROM BIOS (Version 3.06) as some of the other machines tested here, and the Logix machine had no problem running with the Intel Above Board installed (even though I could not get the cover on with that card in place).

The computer handled both the DOS 2.0 boot test and the 3½-inch drive test without a hitch. Installing the drive was tricky because the floppy drive controller cable did not have the key in the connector. The key is a small tab that fits into a notch on the drive's edge connector and prevents you from attaching the cable backward. This feature is an important aid for novices, but since you don't have any room to add another drive anyway, most users

won't ever encounter the problem.

The IBM Enhanced-style keyboard was a MaxiSwitch with the XT/AT switch and the relocatable Caps Lock/Ctrl keys. The keyboard connector on the motherboard was flimsy at best, and substantially poorer in quality than what most of the other

### *The Logix ATC 286 came with the IBM DOS manual still in its shrink-wrap!*

machines offer. This is a bad place to be skimping on component quality; I experienced frequent keyboard failures.

Another keyboard-related problem was the speed change feature. The computer would not respond to the Ctrl-Alt-minus combination to toggle between fast and slow speeds. It turned out that the motherboard was configured for high speed only; once the jumper was relocated, the keyboard command worked fine.

**THE ALL-AMERICAN MACHINE** The computer came with a full megabyte of RAM installed on the motherboard. Again, the components were not familiar, but the RAM chips did present an interesting marketing concept. Each one had a tiny American flag silk-screened on its top, perhaps to imply that this is a home-grown, Yankee Doodle AT. Though there was a full megabyte of RAM installed, the motherboard came with an annoying requirement that it be configured either for 640K DOS RAM with no bytes Extended or for 512K DOS with 512K Extended. I want a full 640K of DOS memory, but I don't want to throw away 384K of chips to get it.

The ATC 286 came with other evidence of its all-American heritage. The hard disk was formatted and had IBM PC-DOS 3.3 already installed, along with some diagnostics, public-domain, and shareware programs. One of the shareware utilities was a program that blanked the screen after a period of inactivity. This program was executed as part of the

AUTOEXEC.BAT file, but no mention had been made that it was installed. Though I appreciate Logix's thoughtfulness in installing this for me in advance, I imagine a novice might be more than a little disturbed to see his screen suddenly go blank without his touching anything.

**DOCUMENTATION AND POLICIES** The DOS on the hard disk deserves a special note. Unlike many of the machines reviewed here, the ATC 286 not only came with the DOS distribution disks, it came with the genuine, true-blue IBM manual, still in its shrink-wrap!

Unfortunately, the rest of the documentation did not quite live up to that supplied by IBM. There were three skimpy pamphlets covering the motherboard, the monographics card, and the parallel/serial I/O card. The I/O card pamphlet was a cut above the standard brown-wrapper manuals that are common with clones, but the other two would probably prove impenetrable for nontechnical users.

Logix offers a 9-month parts-and-labor warranty, which can be extended to 24 months for a fee equal to 10 percent of the total system price. You pay for shipping to Connecticut, and Logix pays for the return trip.

A \$1,634 price tag for a monochrome system configured with a 30MB hard disk puts the ATC 286 squarely in the middle of the inexpensive AT price range. An EGA system with the same hard disk is priced at \$2,133.

The ATC 286 is not small enough to warrant its limitations, (some of which may not be present in the full-size versions). While Logix deserves credit for playing it straight with DOS, that is not enough to overcome this unit's cramped expansion potential and its problems with the OS/2 disk. In your search for an affordable 286 computer, just search right past this one.—**Alfred Poor**

### **LUCKY STAR INTERNATIONAL Lucky Star GST-2000**

The Lucky Star GST-2000, from Lucky Star International, is a 6/10-MHz model that runs with zero wait states at the higher speed. For the same \$895 basic system price, you can buy a system that will run at



#### FACT FILE

Logix ATC 286  
Logix Microcomputer  
131 Naugatuck Ave.  
Milford, CT 06460  
(800) 248-2140  
(203) 877-6991

**List Price:** Monochrome system with 1MB, DOS, 20MB hard disk, \$1,584; with 30MB hard disk, \$1,634; EGA system with 20MB hard disk, \$2,083; EGA system with 30MB hard disk, \$2,133.

**In Short:** Cramped expansion potential, skimpy documentation, and compatibility problems with OS/2 result in only one logical conclusion: this one is different and should be avoided.

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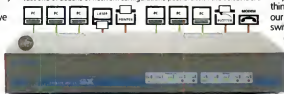
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*What the Lucky Star GST-2000 lacks in documentation, it makes up in speed. The \$895 machine was one of the fastest 10-MHz computers we tested because it operates without wait states. For the same price, a 12-MHz with one wait state is also available, and that configuration is probably the better way to go.*



a clock speed of 12 MHz operating with one wait state. We tested the 10-MHz machine without wait states.

It is a clean-looking machine both outside and in. The 14-inch monochrome monitor comes with its own tilt-and-swivel stand and displays clear, crisp characters. Inside the evaluation unit, the drive bays hold a 3½-inch, 20MB Fuji hard disk and a TEAC 1.2MB floppy disk drive. They are powered by a Seasonic 200-watt power supply with four connector cables for the assorted devices.

**CHIPS AND CONNECTIONS** The standard configuration includes 1MB RAM. But while looking at the memory banks, I was surprised to see two banks of 256K chips and two banks of 64K chips. 512 plus 128 does not add up to 1 megabyte. When I ran the ROM-based setup, I found that it is not possible to configure the 10-MHz machine with 640K main memory and 380K extended memory. You have a choice of 512K and 512K or 640K and 0. Therefore, if you buy the 10-MHz system, you will find only 640K installed on the



## FACT FILE

### Lucky Star GST-2000

Lucky Star International  
1701 Greenville, #602  
Richardson, TX 75081  
(214) 690-6110

**List Price:** Basic system with 1MB RAM, 1.2MB floppy disk drive, \$895; high-resolution monochrome monitor and card, \$140; EGA monitor and card, \$540; 20MB hard disk, \$250.

**In Short:** This well-built system was one of the fastest 10-MHz machines tested. It is best suited for experienced users who don't need a lot of documentation or support.

CIRCLE 677 ON READER SERVICE CARD

motherboard because you can't use the additional 380K anyway. Or at least that's Lucky Star's rationale. This confusion has been fixed in the 12-MHz systems, so why would anyone choose the 10-MHz machine over the 12-MHz? Ignorance is one reason, and the only other possible reason is that the coprocessor cost is greater in the 12-MHz machine.

If you want to install a second hard disk in the GST-2000, you will need an extra cable connector. Other hardware deficiencies include unnotched connectors and a lack of card guides on the back panel. It was nice to see a Hercules-compatible graphics card sitting in slot no. 0, but a slightly mysterious National Computer Ltd. disk controller occupied slot no. 5. Most of the other inexpensive ATs use Western Digital disk controllers without levying a big price penalty on the buyer. Lucky Star should follow suit.

**PERFORMANCE AND CAVEATS** The GST-2000 scored very well among 10-MHz machines on the processing-time benchmark tests: it was often the fastest or tied for the top spot. It did not do as well on the file access tests, however; here it was much closer to the slowest 10-MHz machine than to the fastest.

The documentation accompanying the system leaves a lot to be desired. It consists solely of a "User's Handbook." In the preface, one sentence reads: "Tasks which would have required huge mainframe computers only a few years ago." In the



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CIRCLE 273 ON READER SERVICE CARD



## ■ LOW-COST ATs

"Contents Table" you will find information on "Changing the Clock Speed." In the section on production comparisons, where the Lucky Star system board is shown to have "numerous over" other products, the manufacturer misrepresents the competition, going beyond poor English into poor ethics.

The warranty is a 1-year parts-and-labor contract that requires you to ship your machine to Texas for the repairs. There is a customer support line, but it is not toll free.

At \$1,285 for a GST-2000 system including a monochrome monitor and a 20MB hard disk, Lucky Star has beaten the prices of most of the competition. An EGA system with hard disk sells for \$1,685.

I get the feeling that Lucky Star takes shortcuts where it can and makes somewhat misleading claims for its own advantage. Caveat emptor. But based on the inherent qualities of the machine, I have to admit that it is a good piece of equipment for the price.—Kate Emery

### MICRO 1

#### Micro 1 286 Plus

The Micro 1 286 Plus is a mostly plain-vanilla 10-MHz AT compatible with all the right parts. The 286 Plus has a Phoenix BIOS, which is about as compatible as you can get without being a "real" AT. The machine also lets you switch from 6- to 10-MHz clock speed either from the keyboard



*The Micro 1 286 Plus, \$1,199 with monochrome monitor and 20MB hard disk, was the cheapest AT compatible we tested. Nevertheless, all its component parts carry brand names like Phoenix, Seagate, and Western Digital, and it offers complete compatibility. Its 10-MHz performance was run-of-the-mill, but the price tag alone makes it worthy of consideration.*



### FACT FILE

#### Micro 1 286 Plus

Micro 1  
557 Howard St.  
San Francisco, CA 94105  
(415) 974-5439

**List Price:** Basic system with 640K RAM, 1.2MB floppy disk drive, \$849; monochrome system with 20MB hard disk, \$1,199; EGA system with 20MB hard disk, \$1,549.

**In Short:** The Micro 1 286 Plus is a fully compatible 10-MHz AT clone with a few extras such as an external reset and turbo-mode switches. Documentation is light with this system, but it comes with excellent setup and speed-checking programs.

©1988 MICRO 1 READER SERVICE CARD

or with an external switch.

The basic 286 Plus system comes with the dual-speed 6/10-MHz processor and a 200-watt power supply. Although the power supply has only four leads for storage devices, there is room for five half-height units, three of which are accessible from the front of the machine.

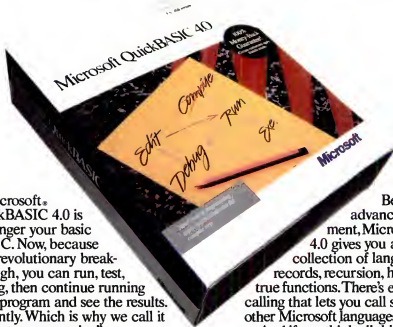
The keyboard included with the 286 Plus is the popular MaxiSwitch original AT-style board, which feels almost as good as the IBM keyboards. The keyboard

plugs into the back of the system unit, as usual, and the cable is 44 inches long.

There are eight full-length expansion slots: two 8-bit XT compatible and six 16-bit AT compatible. You can use either 256K or 64K chips in the four banks of motherboard memory chip sockets. The standard is 640K RAM, and with extra chips you can increase the on-board memory to either 640K or a full megabyte. An additional 15MB can be added on memory expansion boards. The 286 Plus contains



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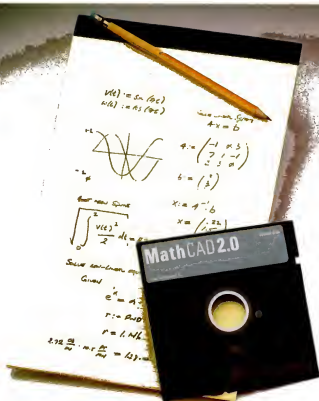
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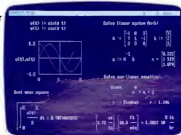
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## ■ LOW-COST ATs

the now-standard Western Digital WA2 floppy/hard disk combination controller and comes equipped with a TEAC 1.2MB high capacity floppy disk drive.

**PERFORMANCE** The evaluation system had a slow 20MB Seagate hard disk and the ubiquitous Samsung amber monitor. The Korean-made Samsungs must be a good deal for vendors, since most vendors supply them. The screens have very good resolution, and I found them pleasant to work with.

The 286 Plus scored just as expected on the PC Labs benchmark tests. All scores based on the processor put the machine in the range of other 10-MHz one-wait-state devices.

To test the Micro 1's ability to handle an advance version of OS/2, I added 3.5MB of memory on an Intel Above Board. The 286 Plus worked perfectly with the extended memory and was comfortable with OS/2 as well. DOS 2.0 also worked in our backward compatibility test, and the computer was quite happy with a 3½-inch 720K floppy disk drive.

The case and the inside of the 286 Plus unit hold no surprises. The unit seems quite rugged, and everything fit as it was supposed to fit with no straining or flexing necessary.

### DOCUMENTATION AND PRICING

Micro 1's hardware documentation is very light. As a matter of fact, it's limited to information about the computer's motherboard. One of the most impressive and convenient features, however, is a standard disk with an extremely easy-to-use setup program. All options and settings are displayed on a single screen, and they can be reset using cursor movements to select categories and using the Spacebar to choose settings. You don't have to reboot the machine to use the program; it can be stored on the hard disk and used anytime. There's also a nifty CPU speed test that visually displays the current processor clock speed. Both the setup and speed test programs are published by Landmark Software.

If the Micro 1 286 Plus is a plain-Jane 10-MHz one-wait-state machine (performance that some would have killed for 3 years ago), pricing helps the unit to stand

out a bit from the crowd. The basic unit—without DOS, a monitor, or monitor adapter but with 640K RAM, the drive controller, one floppy disk drive, and the keyboard—currently lists for \$849. Adding a monochrome adapter, the monitor, a 20MB hard disk, and DOS raises the price to a mere \$1,294.

ATs deserve faster hard disks than the 20MB units used for our price comparisons, but even so the Micro 1 pricing made me sit up and take notice. According to the vendor, most Micro 1 units are sold through authorized dealers, and machines that have problems during the 365-day warranty are serviced by them. If a dealer goes out of business or for some reason the user has no place to send a defective unit, Micro 1 pays shipping both to and from its California facility. This is a better deal than most vendors offer.

Overall, the 286 Plus came with the right parts, ran as it was supposed to run, and is very well priced. It's definitely worth a look. —Bruce Brown

### NORTHGATE COMPUTER SYSTEMS

#### Northgate 286/12 ET

When Northgate Computer Systems sent its 8/12-MHz AT-compatible 286/12 ET for evaluation, I took the system out of the box and I thought to myself, "Did someone drop this thing, or do the floppy drives just normally come installed like that?"



#### FACT FILE

##### Northgate 286/12 ET

Northgate Computer Systems  
2905 Northwest Blvd., #250  
Plymouth, MN 55441  
(612) 553-0631

List Price: Monochrome system with 640K RAM, 32MB hard disk, monochrome monitor and card, 1.2MB floppy disk drive, MS-DOS 3.2, and BASIC, \$1,687; second floppy disk drive, \$99; EGA option, \$495.

In Short: Northgate sells a complete package that is convenient for first-time users. There were some fit and finish problems with the evaluation units, but overall quality is acceptable and the keyboard is very good.

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Although one of the two floppy disk drives (drive A:) was flush with the case, the other, residing below it, was impacted like a wayward wisdom tooth. Then I opened up the box of a second Northgate system and found virtually the same condition. I got very curious, but a Northgate representative said that both systems had been carefully inspected before they were sent out, and he laid the blame on the shipping company. When I pulled the drives out, however, I found that drive B: was actually smaller than drive A: and was barely able to hang onto the rails. Rough shipping or not, it was inevitable that the drive would drop eventually.

Once out of the box and turned on, the 286/12 ET defaults to turbo mode, indicated by a little light on the front panel. When you want to switch modes, you press Ctrl-Alt-Del-minus or -plus to go down to 8 MHz, or up to 12 MHz, respectively. The system uses the Award Modular BIOS 3.0 and has an Astec power supply.

**KEYBOARD AND FEATURES** The machine sports a modified version of the Enhanced AT keyboard. Northgate has it specifically manufactured and talks about its responsive touch with great enthusiasm. The keyboard did have noticeable tactile feedback and was far less mushy than what much of the competition provides, but I wouldn't use it as a replacement for my IBM model.

Inside the 286/12 ET, there is space for five half-height devices, three exposed and two internal. There are the usual eight slots (two 8-bit) with an extra serial port card in the last slot. The standard system comes with 640K RAM, a 32MB Miniscribe hard disk, and a 1.2MB floppy disk drive. The disk controller is a Scientific Micro Systems model, which Northgate says will offer its customers much higher throughput when used in tandem with the Miniscribe hard disk. The benchmark tests did not bear this claim out. After listening to Northgate representatives explain the virtues of RLL encoding and the achievement of a 1:1 interleaving factor, I expected phenomenal results, but the hard disk speeds were just about the slowest reported.

No monitor was shipped, but a Northgate representative explained that the company does supply the usual Samsung



## ■ LOW-COST ATs



*The Northgate 286/12 ET sells as a complete system including monochrome monitor, DOS, and a 32MB hard disk for \$1,687. As one of two 12-MHz machines tested, its CPU performance times were among the best, but its hard disk was disappointingly slow, given the special Scientific Micro Systems controller it uses to offer higher-than-normal throughput.*



monochrome monitor as standard equipment with its systems. There was no DOS software or manuals either, but the representative said that they are normally included. This would be an exception to standard clone policy and, if adhered to, is a proper one.

### PERFORMANCE AND PACKAGING

As a 12-MHz machine, the 286/12 ET should be expected to outperform the 10-

MHz machines on CPU speed tests. It did, but not by a tremendous margin. In fact, a couple of the 10-MHz machines reported speeds that were equal to or better than Northgate's.

The machine was able to boot with OS/2, and it ran the AT diagnostics disk without a hitch.

The lowest-priced configuration that Northgate has to offer sells for \$1,687. This price includes the hard disk and a

monochrome monitor and card. Northgate informs us that this packaging policy is designed to protect the unsophisticated user from himself. The company feels that by bundling the systems, it can offer a much higher-quality machine. Given the benchmark test results, I wonder whether Northgate might be overstepping its rightful role.

Nevertheless, the Northgate seems a pretty good choice, even though the company overrates its advantages. Considering the market in which it is battling, this is to be expected.—Kate Emery

## ORIENTAL PRECISION CO.

### OPC-286

There's something very nice about the OPC-286. It is not the fastest machine in this large group; in fact, it was one of the slowest in our tests. It's also not the cheapest, though it is competitively priced. Many users might never notice—or might not care about—what I think makes the OPC special, but in several ways it was my favorite of the computers I tested.

The key word is *quality*. When I opened the case of the OPC-286, I got a clear impression of excellent design and finish. The edges of the metal frame pieces were rounded, and the chassis felt exceptionally solid. It looked and felt like the quality people refer to when they talk or write about German luxury cars.

One easily noticed feature is the large number of slots in the machine. There are 12 in all, 2 8-bit and 6 16-bit full-length



## FACT FILE

### OPC-286

Oriental Precision Co.  
1031 E. Duane St., Suite A  
Sunnyvale, CA 94086  
(408) 245-0266

**List Price:** Basic system with 512K, 1.2MB floppy disk drive, DOS, \$965; monochrome system with 20MB hard disk, \$1,399; EGA system, call for prices.

**In Short:** The OPC-286 is an exceptionally well-designed and finished computer. Its limit of 8-MHz operation and a possibly incompatible BIOS are slight concerns.

CIRCLE 479 ON READER SERVICE CARD





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CIRCLE 226 ON READER SERVICE CARD



## ■ LOW-COST ATs



*The OPC-286 is meant to be stuffed with peripherals. Standard equipment includes 12 expansion slots (6 16-bit, 2 8-bit, and 4 8-bit half-length) and four externally accessible drive bays. The quality of the system is superior, and with its 230-watt power supply, it is clearly meant to be a workhorse. A monochrome system with 20MB hard disk sells for \$1,399.*



slots and 4 8-bit half slots. This box can handle lots of peripherals and might be a great file server. Add-ons usually require power, even if just for interface cards, so the OPC comes with a 230-watt power supply to handle the heavier potential load. There are only four power-supply device connectors, but you can get around that limitation easily enough with your own Y-connectors.

The OPC-286 box holds up to four half-

height devices, and all of them can be accessed from the front of the machine. The left-hand bay is exposed rather than being hidden as with most AT compatibles.

**FEATURES** Standard features include 512K RAM on a motherboard socketed for up to 1MB, an original AT-style keyboard manufactured by Hitech, and a Western Digital floppy/hard disk combination controller with a Toshiba 1.2MB floppy disk

drive. MS-DOS 3.2 and GW-BASIC 3.2 are also standard.

Unfortunately, the processor on the OPC-286 will work only at 6 or 8 MHz. For that reason most of its speed performance figures are lower than those of the other machines reviewed. The Intech

---

*The OPC-286 is  
one of the least expensive  
of the AT compatibles  
we reviewed.*

---

BIOS also seems a bit off, because the OPC-286 would not run the beta version of OS/2 that most of the other machines handled just fine. DOS 2.0 ran without a hitch, and the computer was very happy to recognize and use the 3½-inch 720K drive I installed.

The OPC-286 uses a diskette-based setup program that works much like the IBM version.

The system's documentation includes a user manual that is clearly written but has only a few illustrations. DOS and BASIC manuals are included as well.

**SERVICE POLICY** If you have a problem with an OPC computer, you may have better luck than with some of the other clones. Oriental Precision Co. has contracted with Mission Peak Systems to provide service at any one of 70 depots throughout the United States. If you didn't buy the machine from a dealer who can help, the odds of being relatively close to a service depot are fairly good, unless you don't live near any major metropolitan areas. Perhaps it would be a good idea to find out where the closest Mission Peak Systems service facility is—if you are concerned about service, as you should be with any computer purchase. OPC's hardware warranty lasts 1 year from the date of purchase and covers both parts and labor.

Given the large motherboard and the high quality of the system, it is a surprise to discover that the OPC-286 is one of the least expensive of the AT compatibles we reviewed. A monochrome system with a



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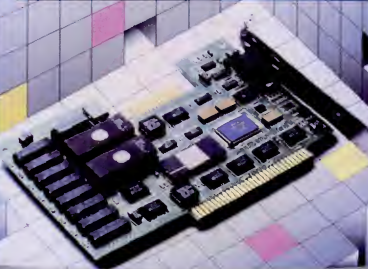
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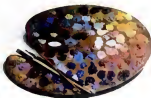
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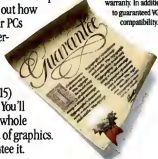
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## ■ LOW-COST ATs

20MB hard disk sells for \$1,399.

I like the finish and the expandability of the OPC-286. If it had a Phoenix BIOS and a 10-MHz zero-wait-state board, it would be even better.—Bruce Brown

### PAN-UNITED CORP.

#### Micro Lab AT-286

The distinguishing feature of Pan-United Corp.'s Micro Lab AT-286 is its zero-wait-state processor. The elimination of processor wait states with this 10-MHz computer boosts the effective speed of the machine above that attained by 12-MHz processors operating with the more typical one wait state.

In addition to the faster processor, the AT-286 also comes with 512K of on-board memory, expandable to 1MB on the motherboard. If you increase memory in the machine, remember that the zero-wait-state system requires memory chips rated at no more than 120 nanoseconds; slower chips probably will not be able to keep up with the processor. The AT-286 scored about 10 to 40 percent faster on our tests than the one-wait-state 10-MHz 80286-based machines. As long as the memory is fast enough, there should be no problem running programs on the AT-286.

### FEATURES AND MODIFICATIONS

The system includes a parallel/serial interface card as standard equipment, along with a DEC VT-200-style enhanced keyboard. The keyboard felt and worked fine.



## FACT FILE

#### Micro Lab AT-286

Pan-United Corp.  
1967 Rt. 27, #12  
Edison, NJ 08817  
(201) 906-8044

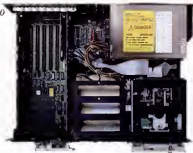
**List Price:** Basic system with 512K, 1.2MB floppy disk drive, \$999; monochrome system including DOS and 40MB hard disk, \$1,599; EGA system, \$1,999.

**In Short:** The Micro Lab AT-286, with its zero-wait-state 10-MHz performance, is a speedy machine, faster than a 12-MHz one-wait-state system. The AT-286 also comes with a parallel and serial interface card.

CIRCLE 69 ON READER SERVICE CARD



*The Micro Lab AT-286 operates at 10 MHz with zero wait states, so its effective performance rivals that of some 12-MHz machines. Though it comes with only 512K RAM, the system's \$1,599 price tag does include a 40MB hard disk, making it somewhat more of a bargain than it might first appear. The AT-286 is definitely worth a look.*



Other components that come as standard equipment include a Western Digital floppy/hard disk combination controller with a TEAC 1.2MB floppy disk drive and a 200-watt power supply with four device connectors. The chassis holds up to five half-height devices, with three showing in front. The evaluation unit also had a 40MB Seagate hard disk.

In order to run our beta version of OS/2, I added some memory with an Intel Above

Board. The Above Board memory chips were rated at 150 nanoseconds, so I had to adjust the AT-286 by locating a clearly documented jumper on the motherboard and resetting the computer to operate with one wait state. With that change, the Above Board's memory ran just fine, as did OS/2.

The AT-286 also ran DOS 2.0 and worked well with the 3½-inch, 720K floppy disk drive I attached to it. The case and parts of the computer all seemed well



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CIRCLE 498 ON READER SERVICE CARD



## ■ LOW-COST ATs

made and suitably sturdy. Everything fit just fine.

Documentation written specifically for the AT-286 consists of a slim but clear and well illustrated 36-page manual. The machine is sold with DOS and also includes full documentation for the operating system and GW-BASIC.

**SERVICE AND PRICES** The Micro Lab hardware comes with a 1-year parts-and-labor warranty. According to company representatives, most of the units are sold through authorized dealers, who also provide warranty service. Pan-United Corp. is in the process of setting up regional service centers by contracting with existing service providers; at the time of testing there were "six or seven" such centers around the country. Pan-United has also started limited mail-order sales as of January, with service available from the regional centers.

Because the base system is unusually fully configured and priced at a moderate \$999, a monochrome system with a 40MB hard disk sells for a competitive \$1,599. EGA systems cost \$400 more.

The AT-286 seems like a fine machine. Of course, I couldn't subject it to any long-term reliability tests, but the generic parts provided are all topflight and everything else worked as documented. This certainly is a speedy computer at a reasonably attractive price.—Bruce Brown

### PC CRAFT INC.

#### PC Craft 286-C

The outstanding feature of the 8/10-MHz PC Craft 286-C is its middle-of-the-road-iness. It did not stand out in any way, but that is certainly no condemnation in this commodity-like market.

The color of the box is a light penicillin green, and the front panel has three lights indicating power, turbo mode, and hard disk access. The monochrome monitor is a Samsung flat-screen model that sits on a tilt-and-swivel base and gives off no glare. It does not plug into the back of the CPU; it requires a normal 3-hole AC outlet.

With the cover off, five half-height drive bays—three exposed and two internal—are visible. One megabyte of RAM was installed on the evaluation unit's



*PC Craft's 286-C offers the standard AT-compatible motherboard with six 16-bit slots and two 8-bit slots. One parallel and two serial ports are also built into the motherboard. The machine is a solid 10-MHz performer, and its \$1,495 price tag (including monochrome monitor and 20MB hard disk) is competitive with the rest of the crowd.*



motherboard (512K is standard), and the power supply (made by PC Craft) is rated at 200 watts, with four connections available. Eight slots—two 8-bit, the rest 16-bit—and one parallel and two serial ports sit on the motherboard. These extra I/O ports on the motherboard are a perk that most other systems did not offer. The disk controller? You guessed it, a Western Digital WA2 model.

The installed floppy disk drive was a 1.2MB TEAC, and the hard disk was a 20MB Fuji. I was told that the floppy disk drive is normally a Fujitsu. Slot no. 7 contained the controller and was not screwed into the mounting. Slot no. 6 was empty, but its covering was not screwed in either. The keyboard connector was sloppy and failed once.

The operation manual is about the right





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1>Prompt Window

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4 Reorder Prompts

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6 Edit Help Record

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CIRCLE 327 ON READER SERVICE CARD



## ■ LOW-COST ATs



### FACT FILE

#### PC Craft 286-C

PC Craft Inc.  
530 Jamie Ave.  
La Habra, CA 90631  
(714) 758-8600

**List Price:** Basic system with 512K RAM, one 1.2MB floppy disk drive, DOS, \$1,095; monochrome card and monitor, \$140; EGA monitor and card, \$595; 20MB hard disk, \$260.

**In Short:** The 286-C is most noteworthy for not being at all noteworthy. It's a straightforward, competitively priced, 10-MHz machine.

CIRCLE #93 ON READER SERVICE CARD

thickness, is written in English, and covers the basics. It doesn't go above and beyond the call of duty, but it performs its designated task.

**SOLID PERFORMANCE** The 286-C ran all the benchmark and compatibility tests flawlessly if not spectacularly. OS/2 came up without a hitch, and the AT diagnostics ran fine. As for the speed tests, if you tried to find a machine that would produce more middle-of-the-road results, you would have to search long and hard.

This is not altogether a bad place to be. When the goal is to be compatible, anyone straying far from the median runs the risk of missing the goal. If you are looking for average quality, PC Craft offers the quintessential AT clone. Its \$1,495 price tag (including monochrome monitor, 20MB hard disk, and 1-year warranty) should guarantee it plenty of customers.

—Kate Emery

#### PC DESIGNS INC.

### PC Designs GV-801

PC Designs sent us the cheapest of their AT compatibles, the 6/8-MHz GV-801. It seems almost silly nowadays to be making a 6/8-MHz machine, but the GV-801 fits into PC Designs' family line, and if you are looking for quality clonemanship, the GV-801 is truly a clone's clone.

The first impression is of quality and a recognition of the typical customer's state of mind when opening a carton of comput-

er equipment. The system just looks good. It is sturdy and attractive on the outside, with the various ports clearly labeled. It is clean and organized on the inside.

The 20MB hard disk is a full-height model that limits the available space for expansion to two half-height exposed devices, in addition to the 1.2MB floppy disk drive that is already installed.

The system I tested includes a driver to control the hard disk and a floppy disk drive, with room for one more of each. The Astec power supply is rated at 200

watts and has five connections for three more devices. The BIOS is American Megatrends' 286-BIOS. There are eight slots—two 8-bit and six 16-bit—and PC Designs has installed an extra serial/parallel port in 16-bit slot no. 5. A Western Digital controller sits in slot no. 7. The hard disk is a Priam 20MB model, and the floppy disk drive is a Toshiba. One excellent perk: you choose from among a 1.2MB, a 360K, or a 3½-inch floppy disk drive as drive A:. No major surprises, but that appears to be the company's strategy—for



*PC Designs never skimps on quality, even in its lowest, low-end AT compatible. The GV-801 comes with name-brand parts and excellent documentation, but its \$2,014 price for a configured system is too high for this market. Loyal PC Designs customers should investigate the GV-286 line, which offers speedier performance for a little more money.*





## ■ LOW-COST ATs

better or worse—and in this manner PC Designs excels. The only surprising feature was the GV-801's FCC compliance rating of A rather than B.

**FINE DOCUMENTATION** The most admirable aspect of the PC Designs system is its documentation. For a new user, it serves as a good orientation. For the experienced user, it gives helpful hints and suggestions—and explains the reasoning behind the suggestions. For the techies, there's no shortage of pinouts and address maps. The manual came bound in a three-ring binder marked "Preliminary," but I found it more readable, interesting, and helpful than any of the other companies' more polished manuals.

Again it appears that PC Designs has taken to heart the mind-set of the new user and done its best to smooth the way from box to desk and efficient use. Apparently the company has succeeded in keeping its customers happy because, unlike most of the others, the PC Designs customer support line is a toll-free number.

**PERFORMANCE AND POLICIES** The GV-801 did manage to be the slowest-running machine of the bunch, but it was always as fast as the IBM AT, and that is all it claimed to be. It ran AT diagnostics, but would not boot with OS/2.

PC Designs offers a 1-year factory parts-and-labor warranty, but you must send the system back. There is also a 30-day money-back compatibility guarantee.

Pricing is on the expensive side for this market. The evaluation unit, with monochrome monitor and 20MB hard disk, was priced at \$2,014.

The system, though unremarkable in terms of performance, looks to be of higher-quality craftsmanship than most of its competitors, and it is superior in the docu-

### *The most admirable aspect of the PC Designs GV-801 is its documentation.*

mentation and support departments. The GV-801 lends itself to the new-user market well. My recommendation to such an audience, however, would be to take a look at the GV-286 10- or 12-MHz machines, two systems that were too expensive for this roundup. I would imagine that the quality and documentation are likewise top-notch, and the additional processing power may make more sense. —Kate Emery

## PROTEUS TECHNOLOGY CORP. Proteus 286F

Proteus (I couldn't help looking this up) was a god of the sea who had the power to assume various forms. You figure out the connection between that and Proteus Technology Corp.'s 286F.

The Proteus 286F has the definite form of an AT clone, and it's a good one at that. It comes in an attractive box with a reset button and power, turbo, and disk activity lights on the front panel. There are three openings for floppy disk drives, one of which was filled on the evaluation unit with a 1.2MB TEAC drive. The monitor is Proteus's own (yet another form?), and though it seems picaresque to mention, it bothered me that the Proteus sticker was already peeling off, giving the monitor a shoddy appearance. I was also disturbed that the monitor's on/off switch was on its back side. Why not in front?

Inside is a full-height Miniscribe hard disk, which seems an unnecessary waste of space for 20MB of mass storage. The

floppy disk drive is a TEAC 1.2MB, and these two devices are controlled by the usual Western Digital WA2 controller. The drive connectors are clearly labeled and notched, a considerate gesture. There are one parallel and two serial ports on the motherboard, 1MB of installed RAM, and a 195-watt Proteus (there you are again) power supply. There are four power connections coming from the power supply, but in keeping with the spirit of ever-changing forms, Proteus informs us that the normal configuration will be five connections.

The system comes with the 84-key original AT-style keyboard (as do only 4 of the 21 systems tested), and I'm not sure what the motivation for this is.

This 8/10-MHz system did extremely well on the benchmark tests. In both processor and disk access speed tests, the 286F excelled. In the Instruction Mix and Floating-Point Calculation tests, it even outperformed the 12-MHz machines. The machine would not boot with OS/2, but Proteus said that customers wishing to run OS/2 can get the upgraded BIOS chip directly from the company.

## HEAVYWEIGHT DOCUMENTATION?

At first glance, the documentation appears to be a very high-quality piece of work. Indeed, the weight of the paper is probably excessive—I'm not sure why Proteus has provided cardboard-like pages unless they think that manuals are weighed for quality rather than being read.



## FACT FILE

### PC Designs GV-801

PC Designs Inc.  
2500 N. Hemlock Circle  
Broken Arrow, OK 74012  
(918) 252-5550

**List Price:** Basic system with 1MB RAM, 1.2MB floppy disk drive, \$1,200; monochrome monitor and card, \$275; 20MB hard disk, \$539; NEC Multisync monitor and EGA card, \$844.

**In Short:** The GV-801 is a solid 8-MHz performer, but fans of PC Designs would do better buying the slightly more expensive but stronger-performing GV-286.

CIRCLE 671 ON READER SERVICE CARD



## FACT FILE

### Proteus 286F

Proteus Technology Corp.  
Airport 17 Center  
377 Route 17  
Hastebrook Heights, NJ 07604  
(201) 288-8629

**List Price:** Basic system with 512K RAM, 1.2MB floppy disk drive, \$1,495; monochrome system with 1MB RAM, 20MB hard disk, Hercules-compatible adapter, hi-res monitor, \$1,995; EGA system, \$2,395.

**In Short:** On the expensive side in this crowd, but very well constructed and backed by excellent support.

CIRCLE 669 ON READER SERVICE CARD



# While the DAISYWHEEL needs a hand, the OKIDATA LASER gets applause.

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August 28, 1987

Mr. Michael A. Mansueti  
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San Francisco, CA 94107

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Mr. Michael Mansueti  
444 Palo Alto Avenue  
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August 28, 1987

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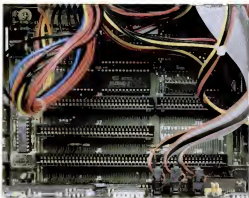
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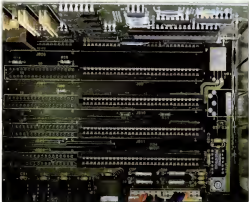


## DETAILS, DETAILS

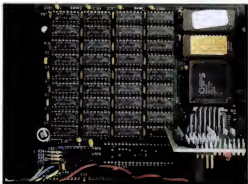
One drawback of buying any computer over the phone or through the mail is that you won't have a chance to do your own hands-on evaluation before you write the check. These photographs point out some of the good and the bad (and the amusing) features we spotted while evaluating these machines and that you should consider as you shop long distance.



One design quirk of the Bentley 286/8 is that one of the half-length slots is essentially unusable because the ribbon connectors get in the way and block it off.



The OPC-286 has a motherboard that includes an extra 4 expansion slots, bringing the total for the machine to 12. The system is clearly designed for heavy usage.



Some of the chips imbedded in the motherboard of the Logix ATC 286 feature tiny little American flags that patriotically testify to their red, white, and blue origin.



The disk drive housing of the 786 Stanford Systems 286-10 is substandard. It's warped and out of line with the rest of the chassis, making secure drive installation difficult.



Another sign that the OPC-286 is meant to be used intensively is the inclusion of four externally accessible disk drive bays on the front of the machine. The computer also has a 230-watt power supply.



## ■ LOW-COST ATs



*The Proteus 286-F is available in a wide range of configurations, all built around the standard AT-compatible motherboard. The \$1,995 unit we tested included a monochrome monitor and 20MB hard disk and was an extremely fast 10-MHz performer. Its warranty is among the best, featuring 60-day on-site parts and labor service.*



Once you begin turning the pages, you will find that you are exercising your fingers more than your mind. There isn't a lot of useful information. I'm not even sure whom Proteus sees as its customer. The new user would feel alone and confused by the documentation's reference-type approach, while power users would feel cheated. No operating software comes with the standard package, but the *Little*

*Black Book* diagnostics/setup package is included.

**POLICIES** The warranty is one of the best. Proteus offers a 60-day on-site parts-and-labor warranty. After this period, you can choose to purchase a continuation of the on-site service or take the free send-in warranty on parts and labor, which covers 15 months from date of purchase.

The 286F with monochrome monitor and 20MB hard disk is priced at \$1,995. An EGA model sells for \$2,395. Many configurations are available, and perhaps that is the best clue to the meaning of the company's name.

The 286F is an extremely fast 10-MHz machine that does what it claims to do and backs that up with an aggressive support plan.—Kate Emery

## 786 COMPUTER SYSTEMS

### 786 Stanford Systems 286-10

786 Computer Systems advertises its 786 Stanford Systems 286-10 computers as "State of the Art." But while the company offers one of the faster machines tested here, these computers appear to come more from the State of Disarray.

From the outside, the SS 286-10 looks identical to a number of the other machines reviewed. It has a downsized chassis, a motherboard socketed for 1MB of RAM, and five half-height disk bays, three of which have openings in the case. It comes with a Unitek keyboard, Award BIOS chips, and a 1-year warranty.

From this point, the SS 286-10 diverges from the norm. On the plus side, the motherboard does not try to cram a 16-bit card connector into the last half-card length position. Others do, and they end up wasting the extra connectors because a 16-bit card won't fit with a hard disk installed.

**DESIGN PROBLEMS** The motherboard does have problems of its own. For example, it comes with the annoying yet not unique inability to address a full megabyte of RAM while configured for 640K DOS memory. With a fully populated motherboard, you must choose either 512K regular memory with 512K extended or 640K regular and zero extended. In essence, you buy 512K of chips and then use only 128K of their capacity.

In addition, when installing the Intel Above Board for the OS/2 compatibility test, I discovered that at least one 16-bit slot will not accept a full-length card, although it is designed to do so. The reason is that extra-long connectors were used to jump wires to pins on the motherboard,



## ■ LOW-COST ATs



786 Computer's Stanford Systems 286/10 is a 10-MHz AT compatible with a couple of design quirks. At least one of the 16-bit slots does not accommodate a full-length card, though it is designed to do so, and the disk drive bay cage on the evaluation unit was bent out of shape, making installation of a 3½-inch disk drive for testing rather difficult.



and the plastic connectors were too tall to allow the expansion card to be inserted far enough to seat properly.

Yet another hardware complaint stems from the fact that the computer offers five half-height bays but only four power connectors. The power supply itself is rated at a substandard 180 watts, so you might not want to add too many cards or drives anyway.

Inserting disk drives might be somewhat tricky, judging from the evaluation

unit. The metal cage that surrounds the disk bays was bent out of shape, making installation more difficult.

**SLOPPY DOCUMENTATION** I expect that most mail-order users will be fairly self-sufficient in terms of technical skills, but there are some who will simply want to open the box, plug the unit in, and begin to work. For these people, complaints about the interior configuration may not mean much, since they might not be interested in



## FACT FILE

### 786 Stanford Systems 286-10

786 Computer Systems  
1887 O'Toole Ave.  
San Jose, CA 95131  
(800) 248-4786  
(408) 435-1515

**List Price:** Basic system with 1MB RAM, 1.2MB floppy disk drive, \$1,049; monochrome system with DOS, 20MB hard disk, \$1,700; monochrome system with 40MB hard disk, \$1,914; EGA system with 20MB hard disk, \$2,102; EGA system with 40MB hard disk, \$2,316.

**In Short:** High speed and good compatibility are not enough to overcome the construction and documentation problems found with this computer.

CIRCLE 888 ON READER SERVICE CARD

going inside the case. Unfortunately, the SS 286-10 lets these folks down too. The documentation is awful.

The evaluation unit came with an elegant manual in an attractive slipcase. The pages covered everything from initial installation and the addition of new peripherals and expansion cards to basic DOS functions. It even included layouts and configuration information for two varieties of motherboard. The tragic flaw was that the manual was written for the ELT-286 motherboard computers, and the SS 286-10 received for review had a totally different motherboard. Almost none of the configuration information matched, and this means guaranteed disaster for a novice user.

According to a 786 representative, an error was made in the shipping room. There is a separate, hard-cover manual that covers the generic aspects of installing and running an AT-compatible machine; this should have been shipped in place of the ELT-286 manual actually received. The correct manual still did not show the configuration information, however.

The motherboard configuration is explained in a tiny 25-page pamphlet, written in classic "Taiwanglish." For example, there is a rubber-stamped notice on the title page: "IBM PC, PC/XT, PC/AT are registered trademarks of." The manual instructs the user to press Ctrl-Alt-Slash to change processor speeds, when in fact the



**What to do  
if you  
don't know  
which  
local area  
network  
to buy.**



# Just ask.

## Why a network?

First things first.

Chances are, you already think you might be able to use a network or you wouldn't be reading this.

But you may not know exactly what a local area network can do for you.

Typically, a local area network can help a group of people and their personal computers work together by letting them share information, files, software, and peripherals.

The result of that sharing is that the people on the network can do more, better, in less time.

The next question then becomes, which network?

## Why TOPS?

Good question. And we have a good answer:

TOPS\* is the simplest, most efficient, and most economical network you can buy.

You connect different, incompatible computers, and share files between them as though they spoke the same language.

Because with TOPS, they do.

That makes using the network very straight-forward and easy.

And since TOPS is so uncomplicated, it's economical, too.

## How does it work?

TOPS resides in your microcomputer's memory, so regardless of which application you're running TOPS is always there.

And it allows you to connect Macintoshes, IBM PCs, and Sun Workstations\* and share files among them.

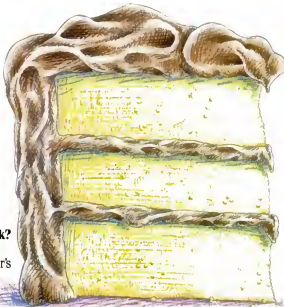
TOPS is a *distributed* server network. So computers share files directly with each other without having to go through a centralized network server where all the files are located.

That's one of the reasons the TOPS Network is so simple, efficient, and cost-effective.

## What's the difference between TOPS and other networks?

The basic difference is that, as we mentioned, TOPS is a distributed server network.

Most other networks require a *dedicated* server where all the files reside. And in order to get at your files—or anyone else's, for that matter—you have to request them.



*Some people say installing TOPS is a piece of cake. But others disagree. They say it's as easy as pie.*

This is an authoritarian setup where you don't have as much direct control over your information.

It's also more expensive. There's a central file server, special cabling, and more often than not, the services of a skilled network administrator are needed to set up and manage your centralized network.

TOPS is more democratic. Every computer on the TOPS Network is both a network station and a network server. Files move easily from one computer to another; you have complete control over your information, and contention problems are far less likely.

## Will we be able to connect different computers?

Different computers or the same

*If you have a phone system, the cable for your TOPS Network is already installed.*



*Dedicated network*



*Dedicated networks use a central file server as a middle-man. Which slows down the whole network with contention problems and costs more besides.*





*TOPS translates files so they can be used by every computer on the network, regardless of its operating system. So all your computers can speak the same language.*

computers. TOPS is designed to connect Macintoshes, Sun Workstations, IBM PCs and compatibles in any combination thereof.

So no matter what the operating system—DOS, UNIX, or Macintosh—TOPS lets you share files and applications between all of your computers.

With TOPS, there are no compatibility problems. Because TOPS translates between file systems, you can access files stored on any other computer on the network just as if they were stored locally.

And that means you can choose the computers and peripherals that are best for you. Because they're all partners on TOPS.

### **How do we share files?**

In a word, transparently. Macintosh folders and MS-DOS directories are known to TOPS as volumes.

To make your volumes available to others on the network, you "publish" them.

Any volumes you don't want shared, you simply don't publish. You can also make individual

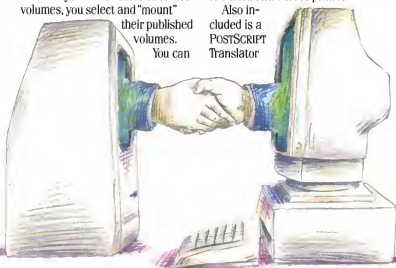
volumes available on a read-only, read-write, one-writer-only, or many-writer basis. And you can assign passwords to certain volumes to further restrict access.

When you want access to others' volumes, you select and "mount" their published volumes. You can

with an IBM PC wants to use a LaserWriter or networked PostScript printer?

No problem. TOPS NetPrint™ software redirects PostScript output to a networked laser printer.

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## ■ LOW-COST ATs

combination is Ctrl-Alt-Backslash. The motherboard is designed to run with no wait states, and according to the manual, "the [RAM] with access time of 100 ns is appreciated for 10-MHz zerowait." Finally, the only clue to the CMOS (complementary metal oxide semiconductor) setup procedures is a small line of handwriting inside the title page: "Ctrl-Alt-Esc activates the Setup program on the BIOS." This hardly gives the impression of a polished product.

**FURTHER PECULIARITIES** The SS 286-10 did not come with a standard disk controller, but with one designed by Computer Systems. It worked fine for a few hours, and then it went down in the middle of testing, crashing the Seagate hard disk in the process. The company sent out another controller/disk combination, which managed to complete our timing tests.

The machine came with no software disks, but the hard disk contained IBM PC-DOS 3.30, IBM Advanced Diagnostics, and a copy of *The Norton Utilities*. A company representative explained their presence by saying that normally the hard disk would be given a low-level format before shipping. This particular machine had been used for testing before being shipped to PC Labs as an evaluation unit; thus the programs were still on the disk.

Since this evaluation of the SS 286-10, 786 Computer Systems has announced changes in the system specifications. A card with a serial, a parallel, and a game port is now included at no extra cost. Also, the company has eliminated the floppy/hard disk combination controller and replaced it with a "high-capacity" floppy-only controller. The prices shown in the features table reflect the fact that if you want to add a hard disk you will have to purchase a separate controller for \$119, bringing the price of a complete monochrome system with a 20MB hard disk to a total of \$1,700.

The SS 286-10 passed all the compatibility tests and produced some of the better performance figures among the machines tested here. Unfortunately, its fit-and-finish factor is extremely low, from the manuals to the misshapen disk bays. In spite of its attractive price, I suggest you look elsewhere. —Alfred Poor

## SOUTHERN CALIFORNIA SYSTEMS INC.

### SCSI 286/10

The Southern California Systems Inc. (SCSI) 286/10 computer is a typical AT clone that runs at 10 MHz. This machine does not toggle or switch between processor speeds. If you want to switch the machine to run at a slower speed, you have to switch clock crystals.

There are no surprises in the test figures for the SCSI 286/10. It runs right in the

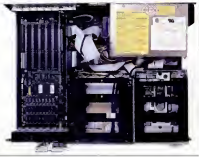
pack with the other 80286 10-MHz one-wait-state machines.

The computer works fine with DOS 2.0 and accepted a 3½-inch 720K floppy disk drive without a problem. I was able to add 3.5MB of memory with an Intel Above Board, but once the memory was installed I was not able to run OS/2, the reason for adding the extra memory in the first place. The SCSI's BIOS, an AMI-C, may be the culprit.

The basic unit comes with 512K RAM, a MaxiSwitch original AT-style keyboard,



*Southern California Systems' SCSI 286/10 gets a gold star for excellent documentation but one demerit for a lack of toggling between its 10-MHz clock speed and any other slower speed. The \$1,420 system we tested included a 20MB hard disk and a monochrome monitor. EGA systems are available for \$300 more.*





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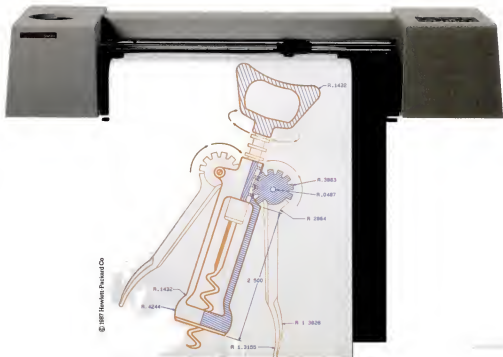
The drawing shown below was produced on the HP DraftPro with VersaCAD software.



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## ■ LOW-COST ATs



### FACT FILE

#### SCSI 286/10

Southern California Systems Inc.  
1480 Lakeview Ave.  
Anaheim, CA 92807  
(714) 777-2943

**List Price:** Basic system with 512K RAM, 1.2MB floppy disk drive, \$985; monochrome system with DOS, 20MB hard disk, \$1,420; EGA system with DOS, 20MB hard disk, \$1,710.

**In Short:** The SCSI 286/10 is a 10-MHz one-watt-state clone. The machine does not run OS/2, but everything else performs just as expected.

CIRCLE 667 ON READER SERVICE CARD

a 200-watt no-name power supply with four device power leads, and an Everex floppy/hard disk combination controller with a TEAC 1.2MB floppy disk drive. The test machine also had a monographics/printer adapter, a Samsung monochrome monitor, and a 20MB Seagate hard disk.

You can install four storage devices in all, but the fronts of only two are exposed. This limitation means that if you use two floppy disk drives you cannot install an internal tape drive as well, a disadvantage for those who want several types of devices in the box.

**DOS OR NO DOS?** No DOS documentation came with the machine. When I called SCSI for specification verification and pricing information, I was told by two people that customers who buy a system with a hard disk but don't buy DOS receive the machine with the hard disk formatted and with the necessary command files to boot the system loaded on the drive. Customers who don't buy DOS don't get the other DOS files or documentation. The inclusion of COMMAND.COM and system files, however, appears to be a violation of Microsoft's copyright.

#### DOCUMENTATION AND POLICIES

A most clearly written and illustrated 200-page operations manual comes with the 286/10. It was refreshing to see a high-quality manual after reading so many weak attempts from other companies.

The 286/10 appears to be very well built. It's backed by a 1-year warranty on parts and 6 months on labor. There is also a 30-day money-back guarantee, a nice feature that some of SCSI's mail-order competitors also offer. If you do have to send your hardware to California for service, SCSI splits the shipping cost; you pay to send the unit to the company, and SCSI pays to ship it back to you.

The SCSI 286/10 is reasonably price-competitive (\$1,420 for a monochrome system with 20MB hard disk), and it performs well. Apart from potential OS/2 incompatibility and the question about command files on the hard disk, I would have no hesitation in using the machine.

—Bruce Brown

#### VECTOR COMPUTER CORP.

### Vector 286

Want champagne on a beer budget? You might have to make some sacrifices, but you may get some of what you seek in the Vector 286.

The big feature about the Vector computer is that it comes with an EGA-compatible display adapter as a standard item, instead of with the monochrome graphics adapter found on most competing models. The Vector comes with a half-length display adapter card from NSI Logic. One drawback is that the card does not include a parallel printer port, and since there were no other I/O ports in the machine, I had to insert my own card to facilitate our testing procedure.

The chassis has bays for four half-height storage devices, one for each of the connectors on the 200-watt power supply. You can reach two of these through openings in the case, limiting you to only two devices with removable media.

Like most EGA cards, the NSI card can handle either monochrome or color monitors. It can emulate EGA, CGA, and MDA (Monochrome Display Adapter) modes, and it goes beyond these to include both Hercules Full and Half modes. This versatile combination gives you good graphics on a monochrome screen, plus the option of upgrading to a color monitor later. I tested the card with the Samsung amber monochrome screen that came with the evaluation unit, and found only one id-



### FACT FILE

#### Vector 286

Vector Computer Corp.  
7 Vernon St.  
Norwood, MA 02062  
(800) 634-6070  
(617) 659-6714

**List Price:** EGA system with monochrome display, 640K RAM, 1.2MB floppy disk drive, \$1,175; with MS-DOS, 30MB hard disk, \$1,670; with 40MB hard disk, \$1,824; with color display, 30MB hard disk, \$1,970; with color display, 40MB hard disk, \$2,070.

**In Short:** The marketing gimmick of an EGA display card as standard equipment makes these prices more appealing, especially for those concerned about the cost of upgrading later.

CIRCLE 666 ON READER SERVICE CARD

iosyncrasy. Instead of presenting the standard slashed zero found on most PC displays, the NSI board produces a small dot in the center of zeros. This is a little distracting at first but should not be considered a significant drawback.

#### KEYBOARD, CHIPS, CONNECTIONS

The Chicony keyboard had a slightly modified IBM Enhanced-style layout—not different enough to cause any problems. It also stood out as having the nicest touch of any keyboard I tried during these tests (which included most of the machines reviewed by others). I have never seen a Chicony keyboard before; its subtle yet firm feedback and quiet mechanical click make it an acceptable replacement for the IBM PC keyboard I love.

The computer uses Award BIOS ROM chips, which are not as popular as the Phoenix set but still seem to provide reliable performance. The Vector machine passed all three compatibility tests, including booting OS/2 with an Intel Above Board installed. According to a Vector representative, the BIOS was a prerelease sample of a new version from Award, identical to the final release version now being shipped.

The Award BIOS also offers a ROM-resident setup utility. You simply press Ctl-Alt-Esc to pop up a configuration screen, which is far easier than loading a separate program.



## ■ LOW-COST ATs



Vector Computer sets its AT compatible, the Vector 286, apart from the crowd by including an EGA display adapter in its \$1,175 base price. A monochrome system including a 30MB hard disk costs \$1,670, and substituting an EGA monitor will add \$300 to the price. The 6/10-MHz system offers high-quality construction and reliable compatibility.



The only snag I found in the compatibility tests came when I was installing the 3½-inch floppy disk drive. The connector on the floppy controller cable did not have the key that matches the notch on the drive's edge connector; thus, it is possible to install the cable with the connections reversed. This is a potential pitfall for novice users.

Also under the hood of the evaluation unit was an Everex floppy/hard disk combination controller and the Chips & Tech-

nologies AT chip set, both fairly standard features of machines in this class. According to a Vector representative, the Vector 286 is now being shipped with the more widely used Western Digital WA2 controller card.

**A USED UNIT** The motherboard holds up to 1MB of RAM, although the evaluation machine came with only 640K. The memory was in the form of two banks of 256K chips and two of 64K chips. The un-

usual feature was that one set was 120-nanosecond rated, while the other was only rated for 150-ns. speeds. This didn't appear to affect performance, but I would be more comfortable with all 120-ns. chips in a 10-MHz machine such as this. A Vector representative explained that the evaluation unit was one used in their own offices and therefore was different in some respects from the shipped versions. According to this spokesperson, all Vector 286s are shipped with only 120-ns. chips installed.

The computer came with a formatted 20MB Seagate hard disk, with DOS, QuickBASIC 3.00, *The Norton Utilities*, and *MOUSE.COM* already installed. None of these programs came with distribution disks or documentation. Their presence was reportedly a result of the machine having been in use in the Vector offices before being sent for evaluation. Under normal circumstances, Vector merely formats the hard disk, installing DOS only if the customer purchases it as an option. The computer did come with a copy of *Disk Manager*, from Ontrack Computer Systems; a set of utilities for installing and maintaining hard disks; and a set of utilities from Vector on a disk.

### DOCUMENTATION AND POLICIES

Documentation was still at the printers when the evaluation unit arrived, but Vector did provide copies of the typeset pages for a few key chapters from the user manual. The information appears to be presented without embellishment, but with somewhat more clarity than many of the competitors offer.

Vector gives a 1-year warranty and splits the shipping costs with the buyer. If there is a problem, you must ship the hardware to Massachusetts, and Vector will ship it back after repairs are complete.

The basic system price of the Vector 286 is \$1,175, including the EGA card. A monochrome system with a 30MB hard disk and DOS lists for \$1,670 and the version with EGA monitor for \$1,970.

The Vector 286 is a solid machine that offers acceptable performance and reliable compatibility. The extra benefit of an EGA thrown in could be an attractive and deciding factor for many buyers.

—Alfred Poor



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- Serial/Parallel Ports
- Enhanced 101 MAXISWITCH Keyboard
- FCC B Class Approved



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- 7 Expansion Slots
- 360K Floppy Disk Drive
- Enhanced 101 MAXISWITCH Keyboard
- FCC B Class Approved

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## ■ LOW-COST ATs

### WALL STREET COMPUTERS

## Wall Street Computers Maxxima

Wall Street: the heart of the nation's financial operations. Fortunes are made (and lost) daily in the high-stakes games of buy and sell. It is little wonder that a computer company should choose to name itself after this well-known route to wealth. Wall Street Computers offers the Maxxima as its entry in the low-cost AT clone market. How will you fare with an investment in this offering?

The machine starts with familiar features. It offers the standard Chips & Technologies AT chip set on a downsized motherboard. The computer comes with a full megabyte of RAM installed, which can be addressed as 640K regular memory and 384K extended. In spite of the smaller case and motherboard, there is a full complement of eight expansion slots: two 8-bit and six 16-bit. One 8-bit and one 16-bit accept only half-length cards.

The evaluation machine came with just three expansion cards installed. There was a VIP monochrome graphics display adapter with parallel port, an I/O card with another parallel and two serial ports, and an Everex floppy/hard disk controller. According to a Wall Street Computers representative, the Maxxima is now being shipped with the more widely used Western Digital WA2 controller.



*We found a couple of problems with the Wall Street Computers Maxxima, the most obvious of which was communication difficulty between the keyboard and the system.*

*Construction of the machine was not up to the standards set by most of the other AT compatibles, and the disk drive bays were exceptionally poor.*



## FACT FILE

### Wall Street Computers Maxxima

Wall Street Computers  
5 Beekman St., #205  
New York, NY 10038  
(800) 247-1937  
(212) 406-4551

**List Price:** Basic system with 1MB RAM, 1.2MB floppy disk drive, \$949; monochrome system with DOS, 20MB hard disk, \$1,474; monochrome system with 40MB hard disk, \$1,624; EGA system with 20MB hard disk, \$1,849; EGA system with 40MB hard disk, \$1,999.

**In Short:** Questionable quality and an OS/2 compatibility problem are foremost in bringing low marks to this computer.

CIRCLE 988 ON READER SERVICE CARD

**ABNORMALITIES** From this point, the machine starts to depart from the norms established by competing machines. To start with, there are only two half-height drive bays available, both of them accessible through holes in the front of the case. This puts a strict limit on how much expansion can be accommodated, since you run out of room after just a single floppy disk drive and a hard disk. The second floppy disk drive connector on the controller cable was not keyed, so there is a danger of installing

it back wards on a drive. This is a drawback for novices who might wish to add a second floppy disk drive.

The Maxxima does offer a reset switch and a turbo-mode switch, both mounted on the front of the case. The turbo-mode switch operates in a rather unusual way, however: it is a toggle switch. The machine powers up in the mode indicated by the switch, since the switch is the functional equivalent of placing or removing a jumper on the motherboard.





## EDITOR'S CHOICE

### • CompuAdd Standard 286/10

More than half of the 21 machines reviewed in this roundup are perfectly acceptable options when you shop for an inexpensive AT compatible. Even removing all the 8-MHz machines from Editor's Choice consideration (10-MHz machines really don't cost that much more) leaves a large group worth mentioning.

At the top of the heap is the CompuAdd Standard 286/10. Fit and finish are excellent, the price is right, and the support is there when you need it. Though its performance won't blow your hair back, its 10-MHz speed should satisfy most users, and its compatibility is flawless.

Also in the top group are the Alttec-286 for its strong 12-MHz performance at a \$975 base price, the CCI ST/286 for the exceptional quality of its construction, and the 47th Street Computer Maxxim 286 Turbo 10 for being the archetypal "call an 800 number and get an AT stuffed with high-quality, name brand parts at a good price" machine.

Shopping in this market requires careful research. Be sure to check the newspapers for the kind of famous-brand bargains pointed out in our "Heard on the Street" sidebar, and always be sure to ask plenty of questions, so you know exactly what you are getting and at what price you are getting it.

The documentation describes a set of keystrokes that was supposed to switch the processor speed, but it did not work. In fact, I experienced some unusual keyboard performance in general.

The keyboard that came with the computer was a BTC model, one that I have encountered before on a number of computers. This modified IBM Enhanced-style model had a fair feel to it, as well as an at-

tractive and useful clear plastic dust cover.

Unfortunately, the keyboard and computer were clearly not in total agreement on how to communicate. I frequently heard a variety of beeps as I was typing on the machine. For example, the Ctrl and Alt keys on the left side worked fine, but the keys with the same label to the right of the Spacebar produced only beeps. When I used the PrtSc key for a screen dump to a printer, the dump was successful, but only after the computer issued three rapid tones. Something was not as it should be.

**DOCUMENTATION AND OTHER DEFICIENCIES** Unfortunately, the documentation that comes with the machine was of little help. It consists of four tiny pamphlets covering individual components: the I/O card, the display adapter, the motherboard, and the keyboard. All are either so general or so technically specific that they are almost useless. A novice would probably be totally lost when confronted with this package.

Equally confusing is the hard disk installation. The disk came with MS-DOS 3.21 already installed. *Disk Manager*, from Ontrack Computer Systems, was also installed; it was used to divide the Seagate hard disk into two logical drives. There were no documentation or distribution disks provided for either DOS or *Disk Manager*. A Wall Street Computers representative explained that *Disk Manager* is bundled free with any machine ordered with a 30MB hard disk or larger, and that the distribution disk should have been enclosed. The DOS was provided for our convenience in the review unit. Under normal circumstances the hard disk is formatted, but DOS is installed only if the buyer has paid the extra charge for it, in which case the distribution disks and manuals are also included.

The computer was deficient in compatibility and construction. It failed the OS/2 compatibility test, although it would accept the Intel Above Board card. I could not positively pinpoint the cause of this incompatibility, but since I have seen other computers work with this hard disk and this controller, the most likely suspect is the Micronic ROM BIOS. According to a Wall Street Computers representative, Phoenix BIOS ROM is available for the

## *The Wall Street Computers Maxxima was deficient in compatibility and construction. It failed the OS/2 compatibility test.*

Maxxima as an option. It is definitely worth the investment.

The case itself is poorly constructed, and the disk drive bays show perhaps the lowest quality of material and finish among any of the machines I saw. Given this level of attention to detail, I was not surprised that there was no FCC rating sticker on the machine. According to a company representative, the machine is rated, FCC Class B, and the sticker was left off the machine by mistake.

**POLICIES** Wall Street Computers offers a 1-year parts-and-labor warranty, but the buyer is responsible for getting the machine to the company and back again. On-site service contracts are available in the greater New York City area, and the 800 sales line doubles as a toll-free support line. The vendor also offers a 30-day money-back guarantee.

The Maxxima ends up presenting a relatively unattractive value in spite of its \$1,474 hard-disk-system price. An EGA system costs \$1,849, and a 40MB hard disk raises the total price of either system by \$150. You are better off selling short on this option and looking elsewhere for a bargain.—**Alfred Poor**

*Bruce Brown, Kate Emery, and Alfred Poor are principals of Soft Industries Corp., an independent computer consulting firm in Southington, Connecticut. Christopher Barr is the manager of the PC Magazine Interactive Reader Service. Catherine D. Miller is associate technical editor of PC Magazine.*



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\*Times in parentheses are with an 8087 or 80287.

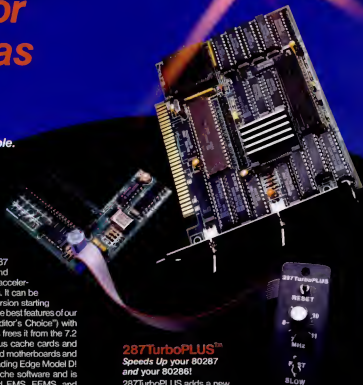
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# VGA COMPATIBLES: GAINING ON THE NEW STANDARD

*The first VGA-compatible display adapters from ATI Technologies, Sigma Designs, STB Systems, and Compaq have found their way to market. But if you want perfect emulation of the real thing, you can either stick with the official Big Blue VGA card or go with the Compaq board that beats IBM at its own game.*



quick. What do the following things have in common? Volcanoes spewing forth fiery lava; roses sporting shades of pink; animated computers giving demos on a computer screen.

Wrong. All are images from IBM's demo for the PS/2. And they make abundantly clear that the new VGA standard displays the most colorful images you've ever seen on an IBM-standard PC display. The VGA's ability to display up to 256 colors from a palette of 262,144 is a far cry from that of its predecessor, the Enhanced Graphics Adapter (EGA), which shows 16 colors out of a possible 64.

Yet the VGA is not the best video system, nor is it revolutionary. Many currently available display systems from companies like Number Nine Computer Corp., Conographic Corp., and Wyse Technology sell display adapters that will give you sharper pictures than the VGA and at least as many colors. While the resolutions of all of those company's adapters top 1,000 by 1,000, the maximum the VGA offers is



## ■ VGA BOARDS FOR ATs

640 by 480. But the VGA has a singular advantage—the IBM imprimatur that virtually assures its wide acceptance as a standard—and consequently the ready availability of compatible hardware and software for it. And unlike the cost of the higher-resolution boards, the VGA's cost is roughly equivalent to that of the 640 by 350 EGA standard that IBM replaced.

While all of the new PS/2 machines have a video adapter built into the system board, IBM has also introduced an add-in board, the Personal System/2 Display Adapter, which allows you to update the graphics capabilities of your existing PC, XT, or AT (though you'll also need a new monitor). Or, you can buy a compatible.

The race to bring out VGA-compatible display adapters has been fast and furious. While there were some initial doubts that outside suppliers could break open IBM's VGA chip and reverse-engineer their own clones (at least legally), the skeptics have been proven wrong. And in this issue, we bring you the proof: here we review IBM's add-in board as well as four compatibles—the VIP from ATI Technologies, Sigma Designs' SigmaVGA, STB Systems' VGA Extra, and the Compaq Video Graphics Controller Board. In addition, a pack of VGA compatibles are due out "any day" from companies such as AST Research, Video-7, Orchid Technology, Tseng Laboratories, Ahead Systems, Digital Solutions, Everex Systems, Intel Graphics, Metheus Corp., Number Nine, Paradise Systems, Genoa Systems Corp., Sirex USA, Supreme Corp., Taxan Corp., Tecmar, and Wyse. The five boards reviewed here cost from \$395 to \$599. In comparison, IBM's EGA card (with 64K of memory) costs \$265, plus \$199 for a Memory Expansion Card and \$259 for a Graphics Memory Module, bringing the total to \$723. EGA-compatible cards typically cost \$395, \$495, or occasionally \$595.

**COMPATIBILITY CAVEAT** All of these products claim complete compatibility with the VGA's wondrous resolutions and display modes. They also purport to plug right into IBM's VGA system, run all its software, and paint their images across the new high-resolution analog color and monochrome displays. But as you'll see,

the truth doesn't hold up to the claims; all of the currently available products, except the Compaq, have some compatibility problems. But in order to understand those problems, you first need to know how IBM's standard works.

**SETTING THE STANDARD** VGA stands for Video Graphics Array, which is simply a descriptive name for the circuitry used to bring the standard to life. IBM uses a large VLSI chip containing a huge number of logic gates—a "gate array"

---

■ **The VGA standard**  
supports up to 256 hues  
on the screen at one time,  
with the colors selectable  
from a total palette of  
262,144.

---

chip—to implement the video circuitry of the various 80286 and 80386 models of the IBM PS/2 line. The one big chip substitutes for and improves upon the off-the-shelf 8450 graphics controller used in the Monochrome Display Adapter (MDA) and Color/Graphics Adapter (CGA). It's a further refinement of the multichip 8450-simulator approach that is used in the Enhanced Graphics Adapter.

For IBM, this method of implementing video circuitry gives the advantage of tighter control over the new video standard because the bigger chip is harder to clone. It's a black box with signals going in and coming out, with its inner workings essentially invisible.

In addition, the single-chip approach is a more cost-effective and space-saving solution to the problem of adding video to the PS/2. In fact, the end-user cost of the VGA system directly from IBM, \$595, is much less than IBM's previous effort at a similarly performing system, the Professional Graphics Controller (PGC), which offered 640 by 480 resolution and sold for \$1,795. IBM is not the only one to win with the

new VGA standard, however. You and your eyes will benefit from the standard in two ways—color and resolution. The available color palette under VGA is wider by a factor of 4,096 than the EGA's 64 colors, and its images are sharper. In addition, IBM has discovered that the world of video is not just black-and-white and has incorporated 64 shades of gray on the monochrome side of VGA.

The VGA standard incorporates 17 different video modes (for a detailed run down on all of these modes, see table "VGA Boards: Available Display Modes"). Of these, the highest color resolution that is supported by the system measures 640 by 480 pixels with 16 colors available on-screen simultaneously; the hues are selectable from a palette of 256,000. At the same level of resolution, the VGA standard also allows for a degraded, two-color (white on black) mode.

Although these new high-resolution modes seem to be a trifling improvement over the 640- by 350-pixel resolution earned with an EGA adapter, they are nevertheless very desirable. Not only are they eye-pleasers, but they result in square pixels on normal monitors that have a 4:3 screen aspect ratio. Square pixels are easier for graphics programs to calculate and manipulate, which should mean that software developers will be able to quickly design new and better graphics software.

Text resolution under the VGA standard is even sharper—720 by 400 pixels in 16 colors or shades of gray in monochrome. Characters in this mode are more detailed than ever before, each constructed from a 9 by 16 matrix of on-screen dots. These same characters are also available in a new 360 by 400, 16-color text mode for 40-column displays. Two other new text modes allow for 30 rows of text on the screen instead of the more-common 25.

While more pixels mean more detail, other VGA modes also improve over previous standards by giving more color. The VGA standard supports up to 256 hues on the screen at one time, with the colors selectable from a total palette of 262,144. In this mode, resolution is limited to 320 by 200 pixels, the same as medium-resolution color mode on the original Color/Graphics Adapter, which offers four simultaneous hues from a palette of 16.





## VGA Boards: Available Display Modes

The VGA standard incorporates the 17 video modes shown in this table. As you can see, the highest color resolution supported by the system measures 640 by 480 pixels, with 16 colors on-screen simultaneously that you can select from a palette of 256,000. At the same resolution, the VGA standard also provides a two-color (white-on-black) mode. At a resolution of 320 by 200 you can use 256 colors at once. Text resolution under the VGA

standard is much sharper—720 by 400 pixels in either 16 colors or shades of gray. Characters in the text mode are also more detailed than with previous standards; each is constructed from a 9 by 16 matrix of on-screen dots. The VGA standard also offers a new 360 by 400 16-color text mode for 40-column displays with characters, again constructed with the 9 by 16 matrix. Two other new text modes allow for 30 rows of text on the screen instead of the

more-common 25. The VGA standard supports the CGA and EGA video modes down to 40-column text and graphics, but with improvements. For instance, in the old-fashioned 200-line video modes (320 by 200 and 640 by 200 graphics), the displays are double-scanned at a 400-line rate, making on-screen characters look sharper but just as chunky as on a 200-line display.

Mode	Type	Resolution	Lines × columns	Character box	Colors	Emulation
0, 1	Text	320 × 200	25 × 40	8 × 8	16	CGA
2, 3	Text	640 × 200	25 × 80	8 × 8	16	CGA
0*, 1*	Text	320 × 350	25 × 40	14 × 8	16	EGA
2*, 3*	Text	640 × 350	25 × 80	14 × 8	16	EGA
0†, 1†	Text	360 × 400	25 × 40	16 × 9	18	VGA
2†, 3†	Text	720 × 400	25 × 80	18 × 9	16	VGA
4, 5	Graphics	320 × 200	25 × 40	8 × 8	4	CGA
6	Graphics	640 × 200	25 × 80	8 × 8	2	CGA
7	Text	720 × 350	25 × 80	14 × 9	Monochrome	MDA
7†	Text	720 × 400	25 × 80	16 × 9	Monochrome	VGA
13	Graphics	320 × 200	25 × 40	8 × 8	16	EGA
14	Graphics	640 × 200	25 × 80	8 × 8	18	EGA
15	Graphics	640 × 350	25 × 80	14 × 8	Monochrome	EGA
16	Graphics	640 × 350	25 × 80	14 × 8	18	EGA
17	Graphics	640 × 480	30 × 80	16 × 8	2	VGA
18	Graphics	640 × 480	30 × 80	16 × 8	18	VGA
19	Graphics	320 × 200	25 × 40	8 × 8	256	VGA

\*Enhanced modes from the IBM Enhanced Graphics Adapter †Enhanced modes

So that you can continue to use all your old software—even if it doesn't have drivers for the new standard—the VGA standard also supports past IBM video modes down to 40-column text and graphics, but with some improvements. For instance, in the old-fashioned 200-line video modes (320 by 200 and 640 by 200 graphics), the displays are double-scanned at a 400-line rate, making on-screen characters look sharper—although they remain just as chunky as on a 200-line display.

**THE QUESTION OF HERTZ** While the VGA system can simulate the function of all earlier official IBM display standards, it does not support monitors designed to function under those standards. Programs that use earlier IBM display modes will work under VGA but only on new VGA-style displays.

As with previous new IBM video standards, taking full advantage of VGA requires an entirely new kind of monitor. To achieve that higher resolution, the VGA

standard imposes a higher horizontal frequency. Because each of its higher-resolution images is made from a greater number of scan lines, each line must be drawn faster. The new standard requires a horizontal frequency of 31.5 kHz, double the 15-kHz rate of the CGA standard and 50 percent higher than the 22 kHz used by EGA displays.

The vertical refresh rate, or frame rate, of the VGA system has been increased to 70 Hz in most display modes. That means



## ■ VGA BOARDS FOR ATs



### VGA Boards: Summary of Features

(Products listed in ascending price order)



**Compaq Video  
Graphics Controller  
Board**  
Compaq Computer  
Corp.  
\$599

	VGA Extra STB Systems Inc. \$395	SigmaVGA Sigma Designs Inc. \$399	VIP ATI Technologies Inc. \$449	IBM PS/2 Display Adapter IBM Corp. \$595	
<b>Standards supported</b>					
MDA	●	●	●	●	●
HGC	●	●	●	○	○
CGA	●	●	●	●	●
EGA	●	●	●	●	●
<b>VGA compatibility</b>					
BIOS	●	●	●	●	●
Register	○	○	○	●	●
<b>Connectors</b>					
9-pin	●	●	●	○	●
15-pin	●	●	●	●	○
<b>Output</b>					
Digital	●	●	●	○	○
Analog	●	●	●	●	●
<b>Maximum resolution</b>					
Graphics	704 × 519	752 × 410	800 × 560	640 × 480	640 × 480
Text	132 × 44	80 × 30	132 × 44	80 × 30	720 × 400
<b>Colors</b>					
Maximum number of on-screen colors	256	256	256	256	256
Total number of colors in palette	262,144	262,144	262,144	262,144	262,144

○—Indicates Editor's Choice ●—Yes ○—No

that the entire screen is redrawn 70 times a second, versus about 60 for CGA/EGA displays and 50 for monochrome. As a result, flicker should be less apparent. The faster frame rate allows for the use of faster phosphors, which mean less image lag and fewer lingering ghosts, particularly when your monochrome screen changes and ambient light levels are low.

The more standard 60-Hz vertical rate is retained only for the two 30-row modes, which trade off a slower refresh rate to squeeze more text onto a screen.

The VGA standard also differs from PC display systems that have come before in that it requires an analog interface. All previous PC systems (except the PGC, which was never intended as a mainstream PC product) use digital interfaces. Any product that does not offer an analog interface is obviously not truly VGA compatible.

In an analog system, the brightness of the on-screen image is determined by the voltage level of the video signal. In a digi-

tal system, image brightness is determined by a digital code expressed as a pattern on several separate wires.

In the CGA system, four signal wires are used for connecting display to adapter, each conveying a single bit of video information—one to control each of the primary colors of light (red, green, and blue) and one for overall intensity. Four bits in a digital pattern allow up to 16 separate states; hence, the CGA system has a palette of 16 colors.

EGA uses three bits for the primary colors plus an individual intensity line for each color, a total of six bits, allowing up to 64 colors.

To support the 262,144 colors of the VGA system—that's 2 to the 18th power—a purely digital system would require 18 separate connections, six per color. Instead of a tangle of wires, the VGA standard uses a diversity of voltage levels on three conductors; one wire is assigned to each primary color and corresponds to an

electron gun in the cathode ray tube of the monitor.

Not only does the analog approach save cabling, but it means that the monitor's circuitry can be simplified—the signal going to the electron beam would have to be converted from digital to analog form to be displayed, anyway. The VGA standard just puts the converter on the video card instead of in the monitor.

IBM chose a particular circuit to make the conversion from computer-generated digital signals to monitor-compatible analog, a chip called a Digital-to-Analog Converter, or DAC. The IBM choice was the Immos 6171S. For the sake of expediency, most VGA-compatible card makers have adopted the same chip, although there's nothing particularly magical about it.

Because of their converter-on-the-card design, digital monitors cannot display the total color spectrum possible under the VGA standard—and so-called VGA cards that run only on digital monitors cannot





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## ■ VGA BOARDS FOR ATs



### VGA Boards for ATs

Overall, the Compaq Video Graphics Controller Board was the fastest of the boards tested on an 8-MHz IBM PC AT. The times for the performance of the built-in VGA on an IBM PS/2 Model 60 and the Compaq Video Graphics Controller Board on a Compaq Deskpro 386/20 are shown for comparison. Naturally, the times of the boards in these machines were much faster because of the speed of the machines in which they were tested.

The Video BIOS test, with and without scrolling, evaluates the speed of test transfer through the boards. This speed is a function of the speed of both the

computer bus and the video board. The Compaq board is the only VGA board tested that can connect to either an 8-bit or a 16-bit slot; the latter connection effectively doubles the board's data transfer rate. As you can see, when the Compaq Video Graphics Controller Board is connected to a 16-bit slot it handles test displays much faster than when hooked into an 8-bit slot. On the other hand, because displays of graphics depend on the speed of the video board itself, the times for the rest of the tests on the Compaq board in both the 8-bit and 16-bit slots are virtually identical.

#### Performance Times

(Times given in seconds except where noted)

#### Windows Performance Tests

##### Full-Screen Windows Test

##### 60- by 20-Line Windows Test

#### Video Benchmark Tests

##### Direct to Screen

##### Video BIOS Routine with Scrolling

##### Video BIOS Routine Without Scrolling

	60- by 20-Line Windows Test (milli-seconds)	Lines (milli-seconds)	Rectangles (milli-seconds)	Scroll (milli-seconds)	Fill (milli-seconds)	Direct to Screen	Video BIOS Routine with Scrolling	Video BIOS Routine Without Scrolling
ATI Technologies VIP	6.0	6.0	19.8	16.2	56.0	5.6	16.8	14.1
Sigma Designs SigmaVGA	5.5	5.5	15.4	13.8	47.6	5.3	12.5	10.0
STB Systems VGA Extra	6.1	6.0	15.9	14.4	50.2	5.6	8.6	8.2
IBM PS/2 Display Adapter	5.5	6.0	22.0	16.5	69.5	6.9	8.5	5.4
Compaq V.G.C. Board (in 8-bit slot)	5.5	6.0	17.0	14.6	39.2	3.6	5.9	4.4
Compaq V.G.C. Board (in 16-bit slot)	5.6	6.0	17.0	14.7	39.5	1.8	2.8	2.0
Built-in VGA on IBM PS/2 Model 60	4.4	4.4	14.3	12.2	56.7	8.7	4.3	1.5
Compaq V.G.C. Board (on Deskpro 386/20)	1.7	1.7	8.2	8.2	34.4	1.7	1.3	0.8

The Windows Performance Tests for VGA cards are run in a Microsoft Windows, Version 1.03, environment under DOS 3.2 on an 8-MHz IBM PC AT, an IBM PS/2 Model 60, and a Compaq Deskpro 386/20. Four Windows call routines—LineTwo, Rectangle, ScrollWindow, and FillRect—are used for the tests. The 60- by 20-Line Windows Test measures the time it takes to perform the LineTwo function in a window that is 60 characters wide and 20 lines down. For the Full-Screen Windows Test, the Lines test measures the time it takes to draw 100

random lines of various colors. The Rectangles test measures the time it takes to draw 100 rectangles of random size and color. The Scroll test creates a rectangle that is 1/2 the height and 1/2 the width of the window in the upper-left-hand corner of the screen and measures the time it takes to scroll to the right pixel by pixel, down pixel by pixel, and diagonally to the upper left pixel by pixel. The Fill test measures the time it takes to fill the window 512 times with a color. The results for the Windows Performance Tests are expressed in milliseconds

per single operation because of the varying size of different screens.

The Direct to Screen benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

really be called VGA compatible. IBM offers four monitors that will run with the VGA: the 14-inch 8512 color monitor (\$595), the 12-inch 8513 color monitor (\$685), the 12-inch monochrome monitor (\$250), and the 16-inch 8514 (\$1,550). You can also use a multitasking monitor. NEC says its MultiSync is VGA compatible (but results aren't as delightful as users might hope, and NEC has released an updated MultiSync II for \$899), as does Zenith for its new flat tension screen ZCM-1490 monitor, which won PC Magazine's

award for technical excellence. Since the VGA compatibility of some other multitasking monitors is questionable, test them out before purchase. PC Magazine will report on analog monitors in an upcoming issue. In the meantime, your best choice may be the Zenith monitor.

The VGA standard incorporates a further refinement that is of particular interest to those who have a multitasking monitor. One adapter can control either a monochrome or color display and can determine the sort of display you plug into it. To im-

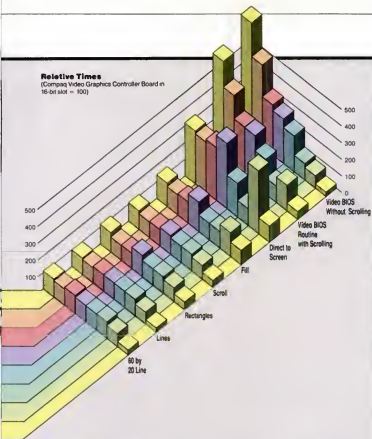
plement that feature—and to prevent your plugging an old-fashioned digital display into the newfangled analog adapter—the VGA standard incorporates a new connector with 15 pins instead of the previous nine. Different pins are used for color and analog signals, and the card circuitry can sense which are being used. When it detects a monochrome display, it shifts to its 64-level gray scale. Color displays get color signals.

To plug a multitasking display into an IBM-standard VGA connection, you'll



# Relative Times

(Compaq Video Graphics Controller Board in 16-bit slot = 100)



The Video BIOS Routine with Scrolling benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 80 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

The Video BIOS Routine Without Scrolling benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 80 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.

need a special adapter cable. Some makers of VGA-compatible display adapters have incorporated the function of such an adapter cable into their hardware designs. Most provide both 9-pin and 15-pin connectors for monitors, so you can use either IBM-standard fixed-frequency analog displays or compatible MultiSync-style monitors without adapting cables.

**A DIVIDED STANDARD** When the VGA's predecessor, the EGA standard, arrived on the scene in 1984, it brought

with it not only new video modes, but also new confusion about product compatibility. That standard divided the issue into two parts, BIOS compatibility and hardware compatibility. The same confusion has arisen with the VGA standard.

Both VGA and EGA cards add BIOS routines to those normally contained inside the ROM firmware of their host computer systems. This added code gives programs one means of addressing the features of the video adapter.

As with the rest of the system BIOS, the

routines in compatible hardware must be able to duplicate the function of the IBM original without directly copying the code that implements them. Programs can access these firmware functions through software interrupts to control the card.

Hardware compatibility goes further. It requires that the supposedly compatible product exactly duplicate the architecture of the original. The registers on the video processor—special memory inside the chip that sets its function—must respond in exactly the same way to a given input as does the original.

BIOS compatibility is relatively easy to achieve because both the input and output of all of its supported commands are fully documented. Designing compatible hardware is more difficult because both the EGA and VGA cards use proprietary IBM chips, the exact design details of which are privy to IBM. Clone makers must determine for themselves which registers do what (and how), and even how many registers are used.

In theory and by plan, BIOS compatibility should be sufficient. Playing by the rules means that software writers should access system functions—including video—only through BIOS routines.

But this grand plan falls short of its ideal because many programmers have found faster, more efficient ways of manipulating video than through BIOS routines. These methods, of course, require direct hardware control. In addition, some features of a certain video standard (or at least, its actual implementation) cannot be controlled solely through the BIOS.

Consequently, true compatibility must reach all the way down to the hardware and register level. So far, only the Compaq product and IBM's own Personal System/2 Display Adapter make that claim. The rest of the products available at the time this is written are merely BIOS compatible with the IBM VGA standard.

Although most of the small amount of existing VGA software works strictly through BIOS routines (for instance, the excellent graphics in IBM's PS/2 tutorials), that guarantee is unlikely to continue indefinitely. Just as EGA software often requires hardware compatibility, future VGA software may be just as demanding.

Worse yet, the lack of true VGA hard-



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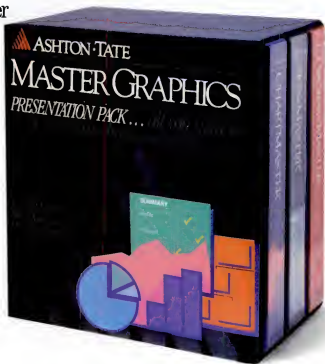
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ware compatibility can pop up when you least expect it—for instance, when you're trying to do something as simple as put a border around a color text screen. This simple task requires hardware compatibil-

ity, something the current VGA adapters cannot deliver.

Even BIOS compatibility does not mean a third-party product will work identically with the official IBM version. Be-

cause the various VGA boards use different code to implement their BIOS calls, they differ in the speed at which they handle such software commands.

For instance, during PC Labs testing, IBM's Personal System/2 Display Adapter ran more than 2½ times as quick as the ATI VIP when BIOS calls were used. On the other hand, the ATI board proved quicker than the IBM by 20 percent when on-screen information was transferred directly to video memory.

**COMPETING AGAINST THE STANDARD** All of the currently available VGA compatibles are trying to grab their share of the market via some form of one-upmanship, even when they're not completely VGA compatible. While the Compaq, which costs the same as IBM's VGA, competes by offering full compatibility and blinding speed, all of the others compete on the basis of price and by offering downward compatibility with non-IBM display standards, notably the Hercules Graphics Card. While IBM's VGA adapter for PCs sells for \$595, the contenders are at least \$100 cheaper, ranging in price from \$395 to \$495.

All take advantage of the many MultiSync-style displays that are currently available—or currently attached to your PC—to reveal VGA-like text and graphics. Most exploit the added abilities of MultiSync displays to transcend the VGA standard with more text modes and even higher resolution.

Alternatively, many of these display adapters will plug into any monitor you currently have—TTL monochrome, CGA, or EGA—while you save up for a new PS/2-style or MultiSync monitor. ATI Technologies, for instance, enables displays to show images meant for otherwise incompatible video standards. For instance, you can plug a CGA monitor into ATI's VIP card and get a flickery semblance of Hercules, EGA, or even VGA graphics on the screen.

**ADDED CONFUSION** Some vendors are seemingly trying to grab a piece of the VGA action by adding confusion to the issue of VGA compatibility. Their tactic is to claim compatibility where none really exists. One acid test: If an adapter connects



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Sigma Designs, Inc.  
46501 Landing Parkway  
Fremont, CA 94538

S I G M A D E S I G N S



## ■ VGA BOARDS FOR ATs

only to digital displays, it is not truly VGA compatible.

Quadram, for instance, has introduced a board called the UltraVGA. But because the UltraVGA lacks a DAC chip, it has no analog outputs, will not function with PS/2-style monitors, and has a displayable color spectrum of 16 colors chosen from a palette of 64. One of its modes of operation duplicates VGA graphics with 640- by 480-pixel resolution in 16 colors, but this feature is common among the so-called EGA Plus cards, which were reviewed in "EGA Plus Cards: VGA Res for EGA Monitors," *PC Magazine*, December 22, 1987. Otherwise, there's little VGA in the UltraVGA.

Like other EGA Plus cards, the UltraVGA's strengths are the other enhancements that it brings to its host computer, specifically a wealth of high-resolution modes. However, these display modes are proprietary to the UltraVGA and require the use of software written to UltraVGA specifications or special drivers to match the UltraVGA modes to programs. Quadram says that it will be announcing a true VGA compatible, which should be available by the time you read this, called the QuadVGA.

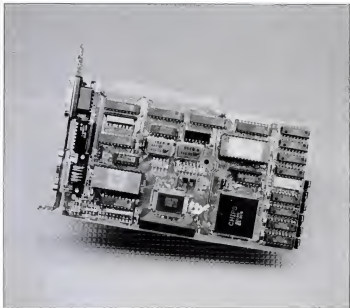
However, if you want to experience the VGA standard—or transcend it—without abandoning all that has come before, these VGA contenders, reviewed alphabetically by their manufacturers, deserve a look.

### ATI TECHNOLOGIES INC.

#### VIP

VIP stands for VGA Improved Performance. The improvement is an ultimate resolution capability of 800 by 560 pixels as well as compatibility with all prevailing video standards—MDA, Hercules, CGA, EGA, and VGA—and 132-column displays.

But some restrictions apply. Only multiscanning monitors can take advantage of the VIP's super-high resolution, and PS/2-style analog displays cannot yield a full 132 columns. Nevertheless, all monitors connected to the \$449 VIP can show text and graphics made by programs operating under any standard up to EGA (including a reasonably good representation of EGA graphics on CGA displays). No miracle



*ATI Technologies' XT-height VIP board is an extraordinarily compact 7 inches long. The sparse layout is due to a proprietary ATI chip in a surface-mounted package that handles most of the board's dirty work. An Immos DAC chip and 256K come with the unit.*

worker, the VIP can't put VGA images on lesser-mode monitors, however.

A VIP feature called Softsense automatically switches the operating mode of the board to match the needs of the software you run. A special utility, VIP-switch, lets you manually select among video modes.

Amazingly compact at a mere 7 inches long and XT height, the VIP looks nearly bare. The sparse layout is attributable to a small proprietary ATI chip in a surface-mounted package that handles most of the hard work. In addition, the VIP used a Chips & Technologies VLSI circuit (prominently marked as an engineering sample, even though the review board was supposed to be a production product) and an Immos DAC chip. Standard equipment also includes 256K RAM soldered to the VIP board.

Setting up the VIP requires adjusting an eight-bank DIP switch that's reachable through the card-retaining bracket. Four of

the switches are devoted to selecting the default (boot-up) video mode. The other four match the monitor type.

Two output jacks are available—a female DB-15 for PS/2-style analog color and monochrome displays, and a female



#### FACT FILE

##### VIP

ATI Technologies Inc.  
3761 Victoria Park Ave.  
Toronto, Ontario  
Canada M1W 3S2  
(416) 756-0711  
List Price: \$449

Requires: IBM PC, XT, AT, or compatible;  
IBM PS/2 Model 30; or IBM Portable PC.

In Short: A unique adapter that puts displays meant for one monitor type on another, and the only VGA BIOS-compatible board that works with the IBM Portable PC display.

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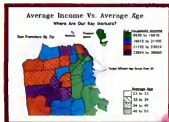
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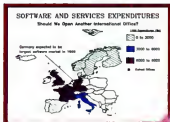
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## ■ VGA BOARDS FOR ATs

DB-9 for all other monitor types. Connecting a PS/2 monitor automatically overrides the monitor DIP-switch setting.

A header is provided for attaching an RF modulator or plugging in a Portable Personal Computer display. In addition, the VIP is compatible with XTs, ATs, the PS/2 Model 30, and all but early PCs.

A jumper allows you to select the I/O address used by the VIP. Both an EGA-style feature connector and a special ATI extended feature connector are also available. Several other jumpers on the VIP are not documented.

ATI Systems supplies two floppy disks of software with the VIP. Included are *AutoCAD*, *Microsoft Windows*, 132-column *Lotus 1-2-3*, and *GEM (Ventura Publisher)* drivers. The VIP board demonstrated a wider variance from the IBM standard than did its peers. Its analog video level was higher than that of the other boards, making a noticeably brighter display with an inappropriately high black level. Although some adjustment of the monitor contrast control can compensate for this defect, it shouldn't be necessary in a properly designed system.

At times the VIP display was fleetingly messy. When changing modes, snow was at times detectable. Additionally, ATI uses slightly different character fonts than

the flickery EGA images regularly on your CGA screen, the feature is there when you need it. It may just be a lifesaver.

### COMPAQ COMPUTER CORP.

## Compaq Video Graphics Controller Board

The \$599 Compaq Video Graphics Controller Board is both an unexpected and exciting addition to the list of VGA-compatible boards on several fronts. First of all, there's Compaq's reputation as a supplier of computer systems rather than peripherals, and of being the staunchest holdout against the emerging PS/2 standard. Therefore, the fact that Compaq has made a board that matches the PS/2 display specification is almost entirely unexpected. Second, Compaq's product is revolutionary in two areas.

The Compaq is the first truly hardware-compatible VGA board with register-level support for all 17 video modes. It's also the first video board from a major manufacturer that uses a full 16-bit interface. That

**EDITOR'S  
CHOICE**

**FACT FILE**

**Compaq Video Graphics Controller Board**  
Compaq Computer Corp.  
2055 FM 149  
Houston, TX 77070  
(713) 370-0670  
List Price: \$599

**Requires:** Compaq Deskpro 386/20, 386, or 286, Compaq Portable 386, Compaq Portable 3; IBM PC, XT, AT, or compatible.

**In Short:** The first truly hardware-compatible VGA board with register-level support for all 17 video modes. It uses a full 16-bit interface. It's the one to get if you want sharp and fast graphics without abandoning your commitment to the PC standard.

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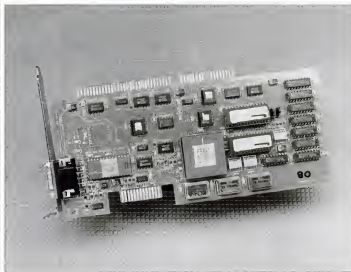
combination makes the board the sharpest, fastest IBM-standard video board you can slide into your PC.

Per the VGA standard, Compaq's board offers 640- by 480-pixel all-points-addressable graphics resolution in 16 colors, as well as 256 colors from a palette of

## ■ The Compaq is the sharpest, fastest IBM-standard video board you can slide into your PC.

does IBM, which are not necessarily bad, just different. Forty-column fonts appear squarer than their IBM equivalents; 80-column fonts actually look a bit sharper, even in normal text modes.

As with all of the products, except the IBM board reviewed here, the VIP proved unable to put a border around the VGA text screen. On the positive side, the VIP is the only VGA video board that attempts to put just about any video mode on any monitor screen. Although you won't want to use



*Although the Compaq Video Graphics Controller Board functions in an 8-bit slot, it achieves top speed when its 16-bit interface is used. The extra edge connector at the top of the board is electrically compatible with the VGA Feature Connector of PS/2 computers.*



## COMPARING GRAPHICS AND TEXT

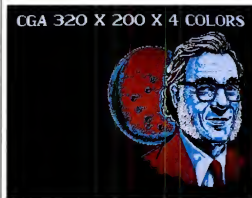
To help you compare VGA, EGA, and CGA output, we show the same image created in each of the three modes. (The image comes from a demo, created in Brightbill Robert's *Show Partner/FX*.) In photo A, you can see the image in the VGA's 256-color mode at a resolution of 320 by 200. The image in photo B, was created in the EGA's 16-color 640 by 350 resolution. Photo C shows the CGA's 4-color 320 by 200 mode. Despite the VGA's low resolution, the number of colors that it allows makes the VGA image more pleasing to the eye.

The quality of a text image depends on both the resolution and the number of dots in the on-screen matrix. As you can see from the screen shots below, the VGA's text resolution is much sharper than that of the other standards.

A



C



B



VGA: 720 by 400 resolution  
9- by 16-character box



EGA: 640 by 350 resolution  
8- by 14-character box



CGA: 640 by 200 resolution  
8- by 8-character box



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## ■ VGA BOARDS FOR ATs

262,144 at 320- by 200-pixel resolution.

Based on a Paradise Systems VLSI VGA chip and an Immos DAC, the board includes 256K RAM soldered to it. Relying on surface-mounted components for just about everything except its BIOS and the aforementioned chips, the entire board is just 9 inches long and XT height. Although it will function in an 8-bit expansion slot, it achieves its top speed only when its 16-bit interface is put into play.

The card-retaining bracket of the board holds only the female DB-15 of the IBM VGA system. This connector, coupled with the analog output of the board, means that the Diamond Board will function only with VGA-style monitors.

An extra edge connector at the top of the board matches the video expansion available on the IBM PS/2 Display Adapter card, electrically but not physically compatible with the VGA Feature Connector of PS/2 computers.

To your system, the board looks like an EGA adapter—that is, you run the appropriate setup procedure for setting CMOS memory as if it were an EGA card. The two jumpers on the board (its only hard-

ware adjustments) alter its base address for matching unusual systems and ordinarily require no change.

### IBM CORP.

## IBM PS/2 Display Adapter

Priced at \$595, the IBM PS/2 Display Adapter is the board the rest of the field must meet or beat. Its advantage over all others is singular—it's the only board that will never need to claim VGA compatibility because it sports the VGA chip itself. Safely ensconced at the center of the board, the big, metal-cased VLSI chip is identical to those that provide the built-in video features of the PS/2 line from the Model 50 up.

The board itself looks like a strange crossbreed. Obviously designed for PC-compatible computers, with an XT-style 8-bit data bus and PC-and-AT retaining bracket, the card itself looks like an add-in card for one of the high-end PS/2 machines. Although a full 13 inches long, it's less than 3 inches high. Besides the 1½-inch-square VGA chip, the board hosts



## FACT FILE

**IBM PS/2 Display Adapter**  
IBM Corp.

Call for name of nearest dealer.

(800) 447-4700

**List Price:** \$595

**Requires:** IBM PC, XT, AT, or compatible, or PS/2 Model 30.

**In Short:** A display adapter for PCs that has complete hardware compatibility with the VGA standard but is not compatible with non-IBM standards and offers nothing above and beyond VGA, as do some of the other boards reviewed here.

CIRCLE 64 ON READER SERVICE CARD

## ■ The IBM PS/2 Display Adapter scores a bull's eye with perfect VGA compatibility at all levels.

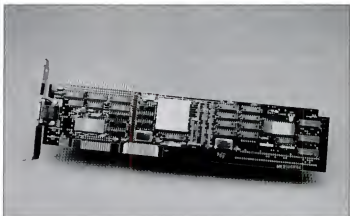
ware adjustments) alter its base address for matching unusual systems and ordinarily require no change.

In testing, the Compaq Board proved itself functionally compatible with the IBM PS/2 Display Adapter but faster, because of its 16-bit interface. On an ordinary AT, it nearly achieved the display speeds of the internal VGA system of a stock PS/2 (which has a clock speed advantage over the AT).

Although Compaq claims that this board is designed specifically for its own machines, particularly the Compaq Desktop 386/20, it works great with non-Compaq machines as well. In fact, with this

256K of video memory, an Immos DAC chip, a BIOS, and a number of support chips, several of which sport an IBM copyright message. Two expansion headers and a third expansion area made from an edge connector at the top of the card hint at future possibilities. One duplicates the function of the VGA Video Feature Connector but uses a different connection scheme. A single female DB-15 connector on the card-retaining bracket mates with any color or monochrome analog fixed-frequency (31.5-kHz) display.

Installation is truly simple—you just slide it in. No jumpers to set, no DIP



Though designed for PC-compatible computers, the 13-inch long by 3-inch high IBM PS/2 Display Adapter, with a metal-cased VLSI VGA chip at its center, looks like it's designed for a PS/2 system. The board includes 256K RAM, an Immos DAC chip, and a BIOS.



## ■ VGA BOARDS FOR ATs

switches on the board to flip. If you must adjust the host computer, just assume you've endowed it with a very special EGA adapter. It's compatible with PCs, XT's, AT's, and the PS/2 Model 30.

The PS/2 Display Adapter can reside with either an MDA or a CGA board, and automatically configures itself as a color-only or monochrome-only board, respectively, in such a circumstance.

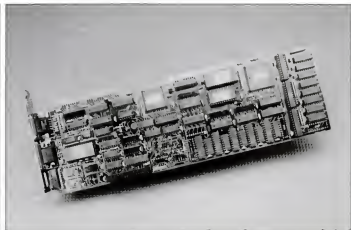
Needless to say, the PS/2 Display Adapter scores a bull's-eye with perfect VGA compatibility at all levels. But though it's in tight with the VGA standard, it acknowledges only IBM standards; consequently, it will not support Hercules graphics. No support software or drivers accompany it.

Moreover, the PS/2 Display Adapter is designed for people who never want to look back. It accommodates no monitors other than those designed to the PS/2 standard. That means, of course, IBM's own PS/2 display lineup and analog MultiSync-style monitors equipped with the proper adapter cable.

### SIGMA DESIGNS INC.

#### SigmaVGA

A follower rather than a maker of standards, the \$399 SigmaVGA promises compatibility with all five primary display standards of today's PC marketplace, including MDA, Hercules, CGA, EGA, and VGA. Under the VGA standard, it claims capabilities matching the IBM specification, including 640 by 480 graphics in 16



The circuitry on the full-length, XT-height SigmaVGA is implemented with custom surface-mounted VLSI chips. Standard features include an enhanced EGA expansion connector, 256K RAM, a 5-pin header for connecting a light pin, and jumpers to set the board's I/O port addresses.

colors, 320 by 200 graphics in 256 colors, and 720 by 400 text in 16 colors with full gray-scale compatibility.

In its VGA modes the SigmaVGA is designed to work with both multiscanning- and VGA-style monitors using two connectors on its retaining bracket. The female DB-9 connects to MultiSync-style monitors, IBM-style TTL monochrome displays, and digital RGB displays that operate under the VGA and EGA standards. A 15-pin VGA-style connector is available for PS/2 displays. An eight-bank DIP switch, accessible through the card-retaining bracket, selects the display type connected to the 9-pin socket.

The SigmaVGA can fully emulate both Hercules and CGA graphics for software that requires one of those standards (for instance, *Flight Simulator* or games). No miracle worker, however, the SigmaVGA requires you to run these modes on a monitor compatible with that standard.

The full-length, XT-height board has a skirt where the substrate dips down to edge-connector level. Although it's cut away to allow the board to slide into AT-style 16-bit slots, it may not fit the 32-bit slots of some compatibles (notably those based on the Intel iSBX 386AT system board) or those boards with high-rise com-

ponents at the far end of the expansion area.

The principal circuitry is implemented with custom surface-mounted VLSI chips, unmarked except for glued-on Sigma Designs labels. An endowment of 256K of video RAM is soldered to the board.

■ The SigmaVGA's blanking during mode changes proved better than the IBM VGA card.

Besides an enhanced EGA expansion connector, the SigmaVGA also includes a 5-pin header for connecting a light pin and jumpers to set the I/O port addresses used by the board. It's compatible with PCs, XT's, AT's, and the PS/2 Model 30.

Sigma includes a number of software drivers, including graphics drivers for *AutoCAD*; *GEM* (including *Ventura Publisher*); *Lotus 1-2-3*, Releases 1A and 2.0; and *Windows*. A text-mode 132-column display driver is also included.



### FACT FILE

#### SigmaVGA

Sigma Designs Inc.  
46501 Landing Pkwy.  
Fremont, CA 94538  
(415) 770-0100

List Price: \$399

Requires: IBM PC, XT, AT, or compatible, or IBM PS/2 Model 30.

In Short: A BIOS-compatible VGA display adapter with excellent backward compatibility to earlier video standards. Includes a wealth of software drivers to put its abilities to work.

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## ■ VGA BOARDS FOR ATs

Compared to other early VGA products, the SigmaVGA works the most smoothly. Its blanking during mode changes proved even better than the IBM VGA card. Its video level was a good match to IBM's.

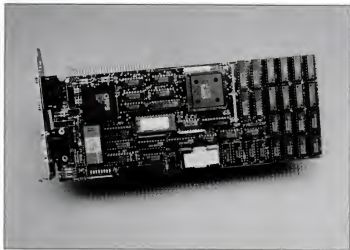
However, the VGA compatibility of the SigmaVGA proved incomplete. Compared to the IBM product, the hues it displayed differed in some modes. Moreover, the SigmaVGA proved unwilling to put a border around the screen in 640 by 480 VGA color text mode. These flaws are traceable to the board's lack of true register-level compatibility. However, the company has announced a true compatible VGA board, which should ship by the time you read this. It will be called the SigmaVGA/H.

Choose the SigmaVGA for its diverse display modes, its smooth operation, and its choice of drivers. It gives you an opportunity to move from yesterday's standards to tomorrow's.

### STB SYSTEMS INC.

#### VGA Extra

The \$395 STB Systems VGA Extra doesn't just embrace every standard display mode, it carefully avoids many compatibility problems as well, putting video meant for one style of monitor on the face of others. Its five mode capabilities—MDA, Hercules, CGA, EGA, and VGA—can be mixed and matched within



STB Systems' XT-height VGA Extra is built around two Chips & Technologies VGA VLSI circuits, an Immos DAC chip, and a proprietary BIOS. Sockets on the 10-inch long board hold 256K of video RAM in 120-nanosecond, 4- by 64-kilobit chips.

the limits of the monitor hardware, even in ways IBM may never have anticipated.

The card itself is relatively compact, only 10 inches long (suitable for short clones, like Tandy's Model 1000) and normal XT height. In addition to compatibility with all standard PCs,XTs, and ATs, the VGA Extra will nestle comfortably within a PS/2 Model 30.

Because of its versatility, the VGA Extra requires a bit of setup. One bank of eight DIP switches, augmented by a jumper, matches the card to the monitor being used and any other display adapters in the host computer. Another jumper alternately enables either an EGA-style expansion connector or 132-column display abilities.

The card-retaining bracket holds two connectors: a female DB-9 for conventional monitors and a female DB-15 for PS/2-style analog fixed-frequency displays. A connector for a light pen is also available on the card itself.

The VGA Extra is primarily built around two Chips & Technologies VGA VLSI circuits, an Immos DAC chip, and a proprietary BIOS. A full 256K of video RAM in 120-nanosecond, 4- by 64-kilobit

chips comes already installed as standard equipment in sockets on the VGA Extra.

Exactly which text modes and graphics standards the VGA Extra can display depends on the monitor connected. The digital interfaces used with TTL monochrome, CGA, and EGA monitors limits the breadth of the displayable color and gray

100% color and grayscale display capability.

■ The STB VGA Extra's five mode capabilities can be mixed and matched within the limits of the monitor hardware.

scales. On the other hand, the VGA Extra expands somewhat on normal compatibility modes, endowing the PS/2 color display with a 132-column text-mode driver for Lotus 1-2-3. Also, special AutoCAD and Windows drivers coax the best performance out of the monitor you connect to



#### FACT FILE

##### VGA Extra

STB Systems Inc.  
1651 N. Glenville  
P.O. Box 850957  
Richardson, TX 75085-0957  
(214) 234-8750  
List Price: \$395  
Requires: IBM PC, XT, AT, or compatible,  
or PS/2 Model 30.

In Short: A VGA BIOS-compatible display adapter (claiming 67 percent register compatibility as well) with excellent backward compatibility to earlier video standards. Includes a wealth of software drivers to put its abilities to work.

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*The LOGITECH HiRez mouse needs 50% less desk space to cover the same amount of screen area as a 200 dpi mouse.*

Which makes this new mouse a hand's best friend. And a more reliable, long-lasting companion—fully compatible with all popular software, and equipped with a Lifetime Guarantee.

Equipped, too, with other advantages exclusive to all Logitech mice: A unique lightweight ergonomic design. Low-angled buttons for maximum comfort and minimum fatigue. An exclusive technology that guarantees a much greater life span. An exceptionally smooth-moving, dirt-resistant roller ball. And natural compatibility with all PCs, look-a-likes, and virtually any software.

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## ■ VGA BOARDS FOR ATs



**EDITOR'S  
CHOICE**

### • Compaq Video Graphics Controller Board

*The Compaq Video Graphics Controller Board is the only non-IBM VGA board that is fully compatible with the IBM standard on both the BIOS and the hardware level. It's also the only add-in video board that can connect to both an 8-bit and a 16-bit slot, and it's the fastest VGA board you can find for an AT or compatible. And when you place it into Compaq's speedy Deskpro 386/20, it flies. So, though Compaq says its VGA board is designed primarily for its own machines, it's also your best bet for an AT or compatible.*

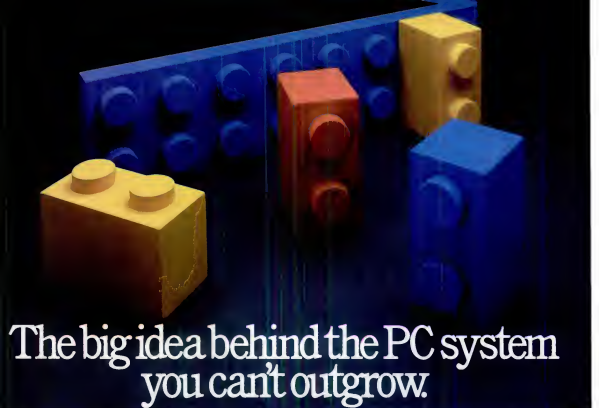
the VGA Extra. EGA monitors can display 852 by 350 pixels; MultiSync-style monitors, 752 by 410 pixels; and PS/2-style monitors, 640 by 480, all in 16 colors.

Although STB claims 67 percent register compatibility for the VGA Extra, the company wisely does not term it hardware compatible with the VGA standard. Although the VGA Extra easily displayed most VGA images, it proved incapable of drawing a border around the active image area. Some colors in some modes were at variance with those displayed by the IBM VGA card. In one compiled BASIC program, a mode switch caused the display to lose sync, which was immediately recovered upon the next mode change. Sometimes mode changes resulted in some unusual but fleeting displays—going from 80-column text to CGA graphics put 40-column text on-screen for about the duration of a single frame.

Although bothersome, none of these minor shortcomings is enough to condemn the VGA Extra. In fact, as a product to help you make the transition to the VGA standard, it's a good choice.

*Winn L. Rosch is a contributing editor of PC Magazine.*





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# How to pick th



Though most mice out there look pretty much alike, they're not all equal in performance. It pays to be just a little choosy to make sure you end up with the right mouse for your needs.

Starting with software. If you want full compatibility with all of your software, all you have to do is look for a mouse with the Logitech name. There are four in all, each one designed for different hardware needs.

## THE HiREZ MOUSE

If you've got your eyes on a high-resolution screen, the mouse to get your hand on is the new LOGITECH HiREZ Mouse.

With a resolution of 320 dots-per-inch (as compared with 200 dpi or less for ordinary mice), it covers the same area on your high-res screen but needs less of your desk to do it. More than 50% less. Saving you valuable desk space, and

Good instincts run in this family (right to left): the LOGITECH Mouse for standard screens (\$99, in bus and serial versions); the LOGITECH Series 2 Mouse for the IBM PS/2 (\$99, plugs right into mouse port); and the new LOGITECH HiREZ Mouse (\$179), the only mouse designed expressly for high-res screens.

Add just \$20 more for Logitech's own Plus Software, which assures ease of use with virtually any software, mouse-based or not.

effort: mouse maneuvers that used to require sweeps of the hand are now reduced to a flick of the wrist.

Which makes this new mouse a hand's best friend. And a more reliable, long-lasting companion. And, like all Logitech mice, it's fully compatible with all popular software, and equipped with a Lifetime Guarantee.

## THE SERIES 2 MOUSE

For those who've chosen the Personal System/2,\* the most logical choice is the LOGITECH Series 2 Mouse. It's 100% compatible with PS/2, and plugs right into the mouse port, leaving the serial port free to accommodate other peripherals.



*The LOGITECH HiREZ Mouse needs 50% less desk space to cover the same amount of screen area as a 200 dpi mouse.*





# e right mouse.

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The three mice pictured to the left come with all this expertise built right in. Which explains an interesting paradox: while you may pay less for a Logitech mouse, you'll surely get more in performance.

And in comfort. With a unique lightweight ergonomic design. Low-angled buttons for maximum comfort and minimum fatigue. An exclusive technology that guarantees a much greater life span. An exceptionally smooth-moving, dirt-resistant roller ball. And natural compatibility with all PCs, look-a-likes, and virtually any software.

All of which leads to an inescapable conclusion: if you want to end up with the right mouse, start with the right mouse company.

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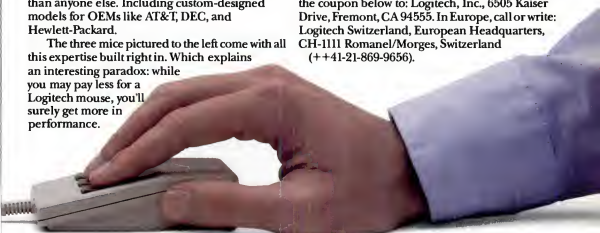


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# FROM OUR MAUS TO BAUMAUSS:

# LOGITECH VS. MICROSOFT

*The new Logitech and Microsoft mice have the right stuff: Logitech's 320-dot-per-inch resolution and three buttons, Microsoft's superb ergonomics and styling. One of them belongs on your desk.*

I'm a mouse pioneer. Back in 1984 I purchased the M-1 optical mouse from Mouse Systems. Friends thought I was crazy because there were almost no mouse-driven applications then, no *Windows*, no paint software, and precious little on the horizon. But I was in love, so I made mouse menus for every piece of software I owned out of spite. By the time I'd acquired mouse number 2 (Logitech's C-7), most all of the naysayers had mice on their desks.



## ■ MICE

While you can use most programs without a mouse, mice can make software easier to use, particularly with pop-up menus, which can double as cheat sheets for more-obscure commands. There are also whole classes of products that are virtually useless without a mouse, like *Microsoft Windows*, paint programs, and desktop publishing software, and this trend is likely to continue with the advent of the Presentation Manager version of OS/2. Now about 10 percent of MS-DOS PCs have mice attached, and the percentage will climb with the advent of still more graphically based programs. *Lotus 1-2-3*, for instance, wasn't much helped or hurt by the addition

■ Most mice have either two or three buttons; the number of buttons determines the number of possible choices that can be programmed.

of a mouse; Microsoft's *Excel* spreadsheet virtually demands a mouse.

A few months ago, *PC Magazine* compared 15 mice from 11 companies as part of a special report on alternate input devices ("Mice for Mainstream Applications," *PC Magazine*, August 1987). Mice are far and away the most popular alternate input device (alternatives include light pens, tablets, trackballs, touchscreens, and specialty keyboards). The optomechanical Logitech serial and bus mice, at \$99 and \$119, received Editor's Choice honors based on their exceptional performance, price, and three-button layout, with the PC Mouse and PC Mouse Bus Plus (\$159 and \$179), from Mouse Systems Corp., accorded honorable mention.

Other major players include:

■ Microsoft, which has the majority of the market with its Alps Electric-made serial, bus, and InPort mice, and which dictates—by its market dominance—that

most software calls for no more than two buttons.

■ IBM, with a somewhat clunkier \$95 two-button Alps-originated offering for the PS/2 line only.

■ Torrington, with a pair of mechanical Manager Mouse models, one of them cordless.

■ Also, American Computer and Peripheral (American Mouse), American West Engineering (MultiMouse), IMSI (IMSI Mouse), Maynard Electronics (Maynard Electronics Mouse), and Summagraphics (SummaMouse).

**NEW STANDARDS** Since then, two major products from Logitech and Microsoft have changed the market. Logitech has finally brought to the general market a \$99 Logitech C-7 mouse that resolves 320 dots per inch, a clear improvement over the 200 dpi of the competition. And Microsoft completely redesigned the look and feel of its mouse. The Logitech mouse is an addition to the 200-dpi product line; the new \$150 Microsoft Mouse replaces the old Microsoft Mouse, which was priced at \$175 and \$195 in bus and serial versions.

**MOUSE BASICS** Here are some basics that differentiate mice from each other. These considerations apply to all mice, not just those from Logitech and Microsoft.

**Interface.** A serial mouse uses one of the two serial ports MS-DOS provides for (recently upgraded to four in MS-DOS 3.3), which may cause problems if you have a mouse, a modem, and a serial printer, while a bus mouse takes up one half-slot and may cost \$25 more. There is no appreciable difference in performance, so the choice depends on your system's real estate. Most serial mice include a short connector that lets you use both 9- and 25-pin serial ports. There also are two specialty connectors that use either Microsoft's InPort standard that isn't really a standard (hardly anybody uses it) or the similarly styled (but different) connector for IBM's PS/2 models.

Microsoft has mice in all four versions (the serial and bus mice have adapters that adapt them to, respectively, the PS/2 and InPort connectors), while Logitech has serial and bus versions and a \$99 two-button, 200-dpi PS/2 mouse. Logitech will contin-

ue to sell its three-button 200-dpi mice as well.

**Buttons.** Most mice have either two or three buttons; the number of buttons determines the number of possible choices that can be programmed. A two-button mouse offers three choices, which makes it easy to learn but may necessitate several steps to complete an action. The three-button mouse offers seven choices, which makes it more difficult to learn but may provide greater flexibility in some applications. Except for CAD, most software requires only two buttons. The Logitech, like any three-button mouse, can be used as a two-button mouse, so there's no disadvantage there, except that the case is somewhat wider and feels less comfortable.

**Tracking system.** The tracking system determines how accurately you can position the mouse cursor. Mechanical tracking uses a hard rubber ball or wheels to turn rollers that send signals to move the cursor. The optomechanical mouse uses the same tracking mechanism, but the rollers use optical elements to send signals. The optical mouse has sensors that read your position from a special tablet printed with a grid and sends grid position signals to move the cursor.

**Drivers.** Microsoft and Logitech both offer two kinds of mouse drivers. (The Logitech drivers emulate Microsoft if needed.) You can either load a device driver (place the statement `DEVICE=MOUSE.SYS` in your `CONFIG.SYS` file) or call `MOUSE.COM` as needed by typing `MOUSE <Enter>`. The ability to unload mouse software and supporting programs from memory is also useful. *Microsoft Windows* has mouse support integral to *Windows*. If you change mice, you have to reinstall *Windows*.

**Software bundles.** Most mice come with some substantial application software. Microsoft's basic package includes *PC Paintbrush* and *Mouse Menus*. For an extra cost, Microsoft includes *Evolution Computing's EasyCAD*, a lower-end CAD program; or *Microsoft Windows*, Version 2.0, and *PC Paintbrush for Windows*. Logitech includes a mouse-based text editor, a pop-up menuing system, and a menu shell for 1-2-3. Logitech also has several extra-cost software bundles aimed at low-end desktop publishing, paint art-



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## ■ MICE



### Logitech and Microsoft Mice:

#### Summary of Features

(Products listed in ascending price order)

FEATURES	Logitech Serial Mouse \$89	Logitech Bus Mouse \$119	Microsoft Serial Mouse \$150	Microsoft Bus Mouse \$150
Position sensor	Optomechanical	Optomechanical	Mechanical	Mechanical
Has Interface for PS/2	●	●	●	●
No. of buttons	3	3	2	2
Power supply	Internal	Internal	Internal	Internal
Cord length (Inches)	72	72	96	96
Menu generator	●	●	○	○
Mouse emulation	Microsoft, Mouse Systems, Summagraphics, Torrington	Microsoft, Mouse Systems, Summagraphics, Torrington	None	None
<b>APPLICATIONS SUPPORTED</b>				
Operating Environments				
Microsoft Windows	●	●	●	●
Spreadsheets				
1-2-3	●	●	●	●
Word Processors				
Microsoft Word	●	●	●	●
WordPerfect	●	●	○	○
WordStar	●	●	○	○
CAD				
AutoCAD	●	●	●	●
VersaCAD	●	●	●	●
Graphics				
Dr. Halo	●	●	●	●
Freelance Plus	●	●	●	●
PC Paintbrush	●	●	●	●
Desktop Publishing				
PageMaker	●	●	●	●
Ventura Publisher	●	●	●	●

●—Yes ○—No

ists, or CAD. Logitech even went so far as to throw together a \$999 mouse/EGA card/EGA monitor deal—a nice idea except that you can put together a NEC MultiSync and just about any decent EGA card yourself for \$800.

**Compatibility.** Mice may have their own emulations, but they all also emulate the Microsoft Mouse because they know who's King Rat—er, Mouse, and many also include a Mouse Systems emulation in deference to the first company to sell

mouse for the IBM PC. Logitech emulates most popular mice and can be used with a variety of drivers, so it wins the Most Versatile Mouse award.

**TWO APPROACHES** The Logitech and Microsoft mice represent contrasting approaches to mouse technology. Logitech places far more emphasis on resolution and maximum price/performance ratios than on ergonomics. Microsoft is banking on its reputation and on thousands of hours of research in developing a new look and feel for a personal peripheral.

Microsoft believes with near-religious fervor that two buttons are just the right amount for the broadest range of users, and that three buttons makes a mouse too wide

■ Microsoft believes with near-religious fervor that two buttons are just the right amount for the broadest range of users.

to be comfortable.

In selecting a mouse you must weigh these philosophies and decide where you place the emphasis. You'll probably conclude that two buttons are enough, unless you have a specific application that benefits from more buttons or more resolution, such as CAD, or if you want to write your own mouse menus (in reality, few users will).

To see how the new mice stack up against the field, PC Labs put the new Microsoft and Logitech mice through a maze of tests, using a range of popular applications and CGA and EGA monitors—plus a 19-inch high-resolution paper-white monitor that you'd likely use for serious work in CAD or desktop publishing. While they weren't reviewed for publication, existing Mouse Systems and Logitech mice and the erstwhile Microsoft mice were tested again for comparison.





# Why you should buy the mouse with no moving parts.

Several reasons. No moving parts. No problems.

The PC Mouse has no moving parts. It is an optical mouse. It's faster. More accurate. And so reliable, it has a Lifetime Warranty. Other mice, like the ones from IBM and Microsoft\*, have a rolling ball, bearings and shafts and lots of other moving parts. Which make a mechanical mouse less reliable. Less accurate.

The PC Mouse gives you digital accuracy and superior software compatibility. PC Mouse works with any software package written for use with a mouse and quite a few that aren't. Designer Pop-up\* menus come FREE with every PC Mouse. Designer Pop-up menus include over 20 pre-configured menus for the most popular software programs, like Lotus 1-2-3.

You also get an easy to use application so you can create your own menus for software programs not originally designed to use a mouse.

The PC Mouse from Mouse Systems comes in three models: PC Mouse (serial), PC Mouse Bus Plus (it comes with a serial Bus card) and our NEW PC Mouse for the IBM Personal System/2.\*

PC Mouse. With no moving parts and no problems, there's no question about which mouse is better.

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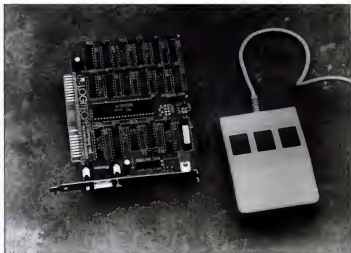


LOGITECH INC.

## Logitech Bus Mouse and Logitech Serial Mouse

The new Logitech mice now offer 320-dot-per-inch resolution in two versions, bus and serial. The half-slot bus interface of the Logitech Bus Mouse can be configured for interrupts 2 through 5 to avoid conflicts with other peripherals. The Logitech Serial Mouse comes standard with a 9-pin connector for the PS/2, plus a 25-pin adapter for PCs—a rather bulky extension that needs 3 inches clearance between PC and wall. Both mice have 6 feet of cord reinforced at both ends. Hardware installation takes just a few minutes and is well documented. The mouse is also sold by Monterm as an adjunct to its high-resolution 1,024 by 768 monitors.

Logitech has had this mouse for some time, but it remained in OEM channels, in part because earlier PC display hardware couldn't show the difference in resolution (a 320-dpi mouse is overkill on a CGA monitor) and in part because Logitech



*Available in either bus or serial versions, the new Logitech Mouse offers plenty of bang for the buck. For \$119, you get 320-dot-per-inch resolution and plenty of software to help you generate menus and take advantage of new display technologies.*



## FACT FILE

### Logitech Bus Mouse Logitech Serial Mouse

Logitech Inc.  
6505 Kaiser Dr.  
Fremont, CA 94555  
(415) 795-8500  
List Price: \$99 for serial mouse; \$119 for serial or bus mouse and Plus Package, including menu-generation software; \$149, including Logipoint (Z-Soft's PC Paintbrush); \$179, including ZFS-First Publisher; \$189, including Generic CADD, Version 3.0, and DotPlot.

Requires: 256K RAM, 25-pin serial port (PC) or 9-pin serial port (PS/2), DOS 2.0 or later. Bus version: half-length slot.

In Short: A high-resolution, 320-dot-per-inch, three-button optomechanical mouse with a complete software package that takes full advantage of new display technology. An excellent choice for CAD or other graphics software, especially if you have a high-resolution monitor or a program that uses all three buttons. An extension of Logitech's 200-dpi mouse line in the same squarish shell, which also includes a \$99 two-button PS/2 version.

CIRCLE 600 ON READER SERVICE CARD

wasn't sure if the market wanted higher resolution. With the advent of VGA and higher-resolution displays, all that changed, and Logitech has released this mouse specifically to address the needs of CAD, paint artists, and desktop publishing. The time spent in OEM channels paid off in improved manufacture and testing, so Logitech's new mouse still costs less than its competition while delivering high-resolution tracking. Volume also helps: while Microsoft has the lion's share of the MS-DOS-based mouse market, Logitech says it's the number 1 mouse maker, with OEM deals with big names such as Digital and more than 750,000 mice produced. (Microsoft, in comparison, contracts with Alps to build the mice.)

Software installation is a matter of choice. The Logitech mice emulate the Microsoft Mouse, Mouse System's PC Mouse, Torrington's Manager Mouse, and Summagraphics' SummaMouse, so in many cases you simply plug in and use the existing drivers, which is important if you have a lot of software configured for a specific mouse. Logitech provides an impressive array of standard software of its own, including mouse drivers that can be con-

figured for Mouse Systems or Logitech mice, and a memory-resident program called Click that maps mouse settings to applications. One neat Click trick is to map the middle button to a combined left-right-button click for existing two-button applications. You can edit Click to add applications or adjust settings.

**MENU SOFTWARE** Logitech's menu-generation software remains one of its biggest values. The software includes compilers, menu sources, and compiled menus. It takes full advantage of the three-button design with chording, which lets you define up to seven combinations of buttons. You can use the buttons to generate commands directly, call pop-up menus, or combine both techniques as needed. Logitech provides Point, an editor with a mouse-based interface, to showcase the various mouse functions. There are also some standard menus—notably a shell for Lotus 1-2-3—but if you don't like the standards, you can always write your own. My only complaint is that the documentation for the menus is indexed along with the Point editor, so it was sometimes difficult for me to look up specific features since I got cross-



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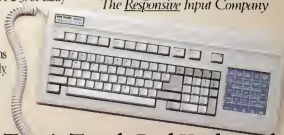
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10 MEGAHERTZ

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## THE SHAPE OF THINGS TO COME

*Microsoft's swoopy new mouse bears little physical resemblance to the first mice developed at Xerox PARC just 2 decades ago, but the heritage is undeniable.*

**L**ike so many developments now common on PCs, the mouse had its origins in the innovative work done 2 decades ago at Xerox PARC (Palo Alto Research Center). The PARC mouse had two rollers for horizontal and vertical motion and a single button. The decidedly boxy shape nonetheless was favored by many developers at PARC and has persisted throughout various mouse incarnations. New mice have broken out of the box, led by the Microsoft mouse.

Microsoft mice have always had an ergonomic design. The broad teardrop shape with two buttons distinguished the Microsoft mice through various upgrades. The original green-button model had a steel ball that spawned an industry in foam mouse pads. The next iteration had larger buttons, a larger body, and a rubber-coated ball, but only 100-dot-per-inch resolution. The latest "old" mouse, the one available through mid-1987, increased resolution to 200 dpi, but the shape remained essentially the same. Typical complaints included a soft feel to the buttons and a too-narrow front.

When Microsoft decided the mouse needed a redesign, it turned to Matrix Design of San Francisco, a company responsible for designing Wyse terminals and Tandon computers. Mike Nuttal, one of the founders, was intrigued by Microsoft's project. Matrix's charge was to reshape the exterior without altering the internal mechanism.

Matrix Design did change one internal element: the position of the mouse

ball. "Almost the first thing we tried was to move the ball forward," Nuttal says. "In the older design the ball sits under the palm, and there's a tendency to put your weight on your palm and the ball. By moving it forward, you can achieve greater accuracy, even though the mechanical resolution is the same." The trick is fairly simple: if you think of the mouse ball as moving in an arc with your wrist at the center, moving the ball farther from your wrist increases the radius of the arc, so the ball travels farther with less motion.

"We knew the buttons had to be bigger," Nuttal says. "We tried several button sizes, and in the process of designing we ended up incorporating the buttons into the body of the mouse." Another change was in relative button size. "We felt the left button should be larger, and when we tested it, the results were better than we had expected, particularly with left-handed users. By making the left button larger, finger position is no longer a factor, so the index finger can curve from lower left to upper right (vice versa for lefties), as it does naturally." Rubber dome switches were replaced with microswitches that had a short travel and better tactile feedback.

Matrix built more than 100 conceptual prototypes using surfboard foam. Fourteen working prototypes were tested over a 9-month period by ex-PARC staffer Bill VerPlank and Kate Oliver, associates of IDTwo, another San Francisco industrial design firm.

Matrix's Nuttal says the design of the new mouse was shaped in part by products outside the computer industry. Nuttal eschewed textured surfaces for high-gloss white plastic on the body because it's easier to clean and doesn't show fingerprints. And the rounded heel that fits so well into the palm of your hand (it feels like an electric razor), the large buttons, the smooth edges—all of this has roots in that most universal of electrical/electronic products, the telephone. Turns out that Nuttal and Matrix Design worked on telephones before mice.

**LOGITECH RESPONDS** Logitech, which has been criticized for the boxy design of its mouse, hasn't ignored ergonomics—especially if you know how to correctly hold the mouse, Logitech says. Logitech's first mouse was an international effort. Professor Niklaus Wirth of the University of Lausanne, Switzerland, spent a year on sabbatical at Xerox PARC in 1970 and returned to Europe to test mouse designs, working closely with Inria, a French design center for office automation products. The final design was a round, 400-dpi mouse with front-mounted buttons. Much argument ensued over the position of the buttons, and the front position won out over the top.

However, Logitech soon found that the buttons on the front made the mouse jump backward slightly when clicked. The design was abandoned in favor of a wedge shape, followed by the rectangular shape used today, with the buttons on

referenced to Point half the time. Separate manuals with a separate index would be a real plus.

I used the Sigma Designs LaserView Plus, a 19-inch paper-white display with 1,664- by 1,200-dpi resolution, with PC Paintbrush and Microsoft Windows running PageMaker, to compare the 320-dpi

Logitech bus and serial versions against the 200-dpi bus and serial versions from Microsoft, and against Mouse Systems' optical PC Mouse. I also tried a CGA comparison for a few minutes, but don't waste your time; at that resolution one mouse looks like another.

The LaserView screen really shows a

marked difference in resolution between mice. The Logitech tracks well and has a solid feel that makes it seem less jumpy than Microsoft's mouse. Logitech also incorporated a suggestion made by PC Magazine columnist John C. Dvorak and others for using ballistic mouse motion: a quick movement with the mouse covers a



top. Pierluigi Zappacosta, president of Logitech, believes technology and industry experience is worth more than a new design. "We are in the mouse business, nothing else," says Zappacosta. "If we had received lots of requests for a new design, you would've seen it. But if consumers like the new [Microsoft] shape, we'll respond."

Zappacosta says the Logitech mouse has the ergonomic features users want: large switches, positive feedback, and if you hold it correctly, a comfortable body. Instead of holding the mouse in your palm, place your wrist on the desk, rest the pad of the knuckles on the back edge, and let your fingers come to rest on the buttons. Zappacosta adds that if you place your wrist on a desk and relax your hands, they will assume the correct position for his company's mouse. Because it has three buttons, the shell has to be a bit wider than that of a two-button mouse.

Traditionally, Logitech has contributed more to internal mouse technology than to ergonomic design. Its strong points remain high-tolerance manufacture at a reasonable cost. Its clients include Apple, which wants Logitech to manufacture the Macintosh mouse, and Hewlett-Packard and DEC, which blend Logitech's optomechanical mechanisms with their own exteriors. DEC's mouse recalls the round shape found in Logitech's first mouse, but the buttons wrap from top to bottom, so you can click either from the top or the side.

—Tom Stanton

bigger chunk of the screen, while slower motions cover less distance on-screen. This made moving around the 19-inch screen easy. The Logitech required only a 5- by 3-inch area to cover a 15- by 12-inch screen, while the Microsoft Mouse used up almost 7 by 4 inches for the same area.

At first glance the PC Mouse and Mi-

crosoft Mouse seemed to perform just as well as the Logitech. It was only after I'd spent a few hours with each mouse that I detected Logitech's improved resolution, especially using *PC Paintbrush*. If you use a mouse for graphics all day long you probably will notice the difference, particularly if you've gone beyond CGA to EGA or VGA. While testing *PageMaker*, I noticed almost no difference in positioning accuracy or tracking.

The Logitech remains the biggest bang for the buck among mice. Both the 200- and 320-dpi versions cost the same, so there is no reason to deny yourself the improved accuracy of the 320-dpi mouse if you have an EGA or better monitor. The Logitech's broad emulation capability makes it the perfect replacement mouse, and the menu software is perfect for the do-it-yourself folks who design custom menus or keyboard macros. For overall performance, you cannot do better than the Logitech. If ergonomics are your first and only concern (see sidebar "The Shape of Things to Come"), you may find fault with this mouse, but for someone looking for an all-purpose mouse, there's no need to look further.

#### MICROSOFT CORP.

### Microsoft Bus Mouse and Microsoft Serial Mouse

The first word out of your mouth when you see Microsoft Corp.'s new mouse is ergonomic, but like most buzzwords it hardly does justice to the way this mouse looks and feels. Microsoft has done a superb job in designing its new mouse, and the attention to detail is not limited to the seamless white body.

Microsoft offers bus and serial versions of its mouse. The Microsoft Mouse uses a half-card with Microsoft's InPort chip, and the card can be configured as the primary or secondary InPort. Additional jumpers select interrupts 2 through 5, and XT users will find a special jumper for slot 8 that has caused troubles for some peripherals. The Microsoft Serial Mouse includes an interface module and adapters for 9- and 25-pin serial ports and for the



## FACT FILE

### Microsoft Bus Mouse Microsoft Serial Mouse

Microsoft Corp.  
16011 NE 36th Way  
Box 97017  
Redmond, WA 98073-9717  
(800) 426-9400  
(206) 882-8088

**List Price:** \$150, including *PC Paintbrush* and *Mouse Menus*; \$175, including *EasyCAD*; \$200, including drivers, *Microsoft Windows*, Version 2.0, and *PC Paintbrush for Windows*.

**Requires:** 12K RAM; 25-pin serial port (PC), 9-pin serial port, or IBM pointing device port (PS/2); DOS 2.0 or later. Bus version: half-length slot.

**In Short:** A dramatic new shape with redesigned buttons and a relocated tracking ball that will be popular among a broad category of mouse users, particularly those using *Microsoft Windows* and related software.

Tracks at 200 dots per inch. Serial version includes connector for IBM PS/2s; bus version includes connector for Microsoft InPort. The best feel of any mouse and the best money's-no-object two-button mouse.

CIRCLE 626 ON READER SERVICE CARD

new PS/2 pointing device port with the small subminiature connector. The mouse has a generous 8-foot cord for the growing number of users who stand their machines on edge next to their desks.

The software package has changed too. Programs are available on both 5¼- and 3½-inch floppy disks, but Brightbill-Roberts' *Show Partner*, a presentation graphics/slide show package, is no longer included. Microsoft believed the latest incarnation, the powerful *Show Partner F/X*, was a bit far afield from the needs of most users.

Mouse drivers and tutorials are standard, but Microsoft now has three software bundles available. The one I tested included *PC Paintbrush* and six *Mouse Menus* for popular applications (\$150). The CAD package includes *EasyCAD* (\$175). The *Windows* package has *Microsoft Windows*, Version 2.0, and Z-Soft's *PC Paintbrush for Windows* (\$200). Microsoft is continuing to look at other software bundles.

One major drawback with the previous



# To some people, the



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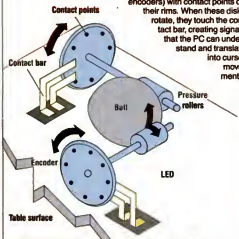




## How a Mouse Works

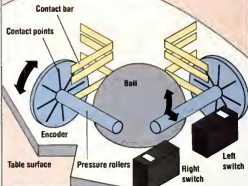
### The Old Microsoft Mouse

The mechanical mouse uses a roller ball. As you move the mouse, the ball turns pressure rollers, placed perpendicular to each other. The rollers attach to rods that connect to disks (called encoders) with contact points on their rims. When these disks rotate, they touch the contact bar, creating signals that the PC can understand and translate into cursor movements.

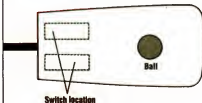


### The New Microsoft Mouse

With a roller ball, encoders, contact bars, and pressure rollers, the new Microsoft Mouse is based on the same technology as the old Microsoft Mouse. However, the roller ball has been moved from the back of the device to the front, and the encoders have been enclosed to prevent dirt from building up.

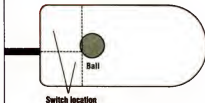


### Old Underbelly



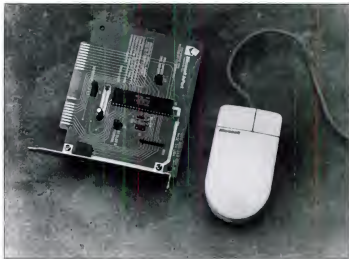
Narrowing at the front and with a wide, high heel, the old Microsoft Mouse (left) has two slender, raised buttons, which offer three choices that can be programmed. The new Microsoft Mouse also has two buttons, but they sit over the roller ball

### New Underbelly



rather than in front of it. Instead of two buttons of equal width, the new mouse's left button is slightly wider than the right, and they are separated by a thin ridge rather than by the surface of the device.





The new two-button Microsoft Mouse departs from traditional mouse design and has an excellent ergonomic feel. For a total price of \$200, Microsoft will bundle the mouse with drivers, Microsoft Windows, Version 2.0, and PC Paintbrush for Windows.

Microsoft Mouse was its lack of menu-generating software, and Microsoft remains unmoved: you still must pay an additional \$25 for the Programmer's Reference Guide and menu software. Microsoft believes that its menu software might be compromised by trying to make it user-friendly, so the company left all the power in the language with the understanding that do-it-yourselfers must know how to do it. This fits in with Microsoft's two-buttons-is-plenty philosophy. Seems reasonable, but I would still like to see a menu-generating subset made available for those of us whose ability to program is commensurate with our ability to find extra desk space.

The on-line tutorials are markedly better. The older version was little more than a slide show the user sat through. The new tutorials are controlled by the mouse, so you participate instead of passively reading, and you gradually learn to use the mouse and then the menus. I was impressed by the quality of the tutorials and recommend them to new users, particularly since the documentation doesn't tell you much about the menus.

**THE AERO LOOK** The new shape of Microsoft's third-generation mouse is a radical departure from what most people thought was a well-designed mouse. Microsoft's first mouse, introduced in 1984, was white with two thin green buttons, and it had the broad teardrop that would be refined in successive versions. I spent several days using the second-generation mouse (the one available until recently) before I tried using the new one. The older Microsoft Mouse is pretty easy to use. It's tapered from front to back, with a high heel, so the hand has a tendency at first to rest on top of the mouse rather than around it. The buttons require more effort than necessary to click, and since the front is tapered, there isn't enough room for both fingers if you have larger-than-average hands.

Moving from the old Microsoft Mouse to the new one was startling. The old design was fairly comfortable; the new one is a sheer pleasure to hold. Microsoft did its homework and the result is a two-button mouse that virtually eliminates hand fatigue. It's wider at the front, with a rounded heel that fits the palm of your hand perfectly. Although it has the same basic

footprint as the older mouse, there is a much larger flat surface and gentler curves so that you don't so much clutch the mouse as guide it. The new mouse is noticeably lighter than its predecessor and much easier to position.

Instead of two slender buttons, the new mouse plays off its smooth lines and incorporates the buttons into the surface. The first inch along the front is all button, so you don't have to leave your fingers in any particular position. The left-button surface is a bit larger than the right button, which should compensate for a wide range of hand sizes, and there's a small ridge between the button surfaces so you can distinguish right from left. The buttons provide solid response for each click, yet they require almost no effort to press. The mouse is so well designed that I had to learn to stop arching my fingers and relax with the new shape. After a few days I found the Microsoft Mouse so easy to handle that switching back to the Logitech Mouse only served to point up its ergonomic faults.

Although the mechanical tracking is virtually the same as with the older Microsoft Mouse, applications seemed to position the cursor better than before, and better than the PC Mouse optical mouse used as a reference did. I tested *PC Paintbrush*, Aldus's *PageMaker*, and *Windows* on the Sigma Designs LaserView Plus and on a standard CGA. The LaserView Plus really shows off the positioning accuracy, and the Microsoft Mouse was equal to this screen. In CGA mode there was no noticeable difference between the old and new Microsoft Mouse, though I much preferred the new one for *1-2-3* and *WordStar* and anything else I could test.

One problem with positioning occurred early in the tests: Microsoft moved the tracking ball forward as part of the new design (see sidebar "The Shape of Things to Come"), which, when you first use it, tends to make the mouse appear jumpy, particularly if you're used to leaning your palm hard on the back edge, as I had done with the older mouse. The cure for this minor difficulty is to shift the weight of your hand forward slightly to keep the nose down, but like the curling fingers it's a learned behavior.

While competitors offer more buttons



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Automatic kerning. And an exceptionally powerful text editor. Byline lets you design page layouts right on your PC keyboard as easily as you now do spreadsheets. It imports data directly from popular business software. Including dBASE, MultiMate, Lotus 1-2-3, (worksheets and graphs), WordPerfect, Wordstar, PC Paintbrush, and other graphics products.

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## ■ MICE



## EDITOR'S CHOICE

### Take Your Pick

Choose the Logitech Mouse for superior price/performance, the Microsoft Mouse for the silkiest feel. A mouse is a personal peripheral, so you should try both. Picking both the Logitech and the Microsoft is more than hedging our bets. Both mice have their places. Taking into consideration all the mice tested in our August 1987 issue, the Logitech, at a \$99-to-\$119 list price, remains the price/performance winner. Technical users, especially if they're using ultrahigh-resolution big-screen monitors for desktop publishing or CAD, will appreciate the Logitech's increased resolution, menu-generation software, and third button—for the few programs that take advantage of three buttons. The 200-dot-per-inch mouse is fine for EGA/VGA monitors; the new 320-dpi version is a treat on the big screen, and there's no disadvantage on more-standard monitors.

The Microsoft mice look and feel great, and for most users, two buttons and 200 dpi is no compromise at all. Microsoft also got religion in the marketing department; it cut the list price of the previous Microsoft mice by \$25 to \$45, and less than a month after the new products' roll-out, the street price of the \$150 Microsoft mice was as low as \$100.

and more programmability, Microsoft has set a new standard aimed at the growing number of Windows users, desktop publishers, and paint artists who use mice all day long as an integral part of their work. Unlike other mice, including Microsoft's two earlier versions, the new Microsoft Mouse is a consumer product that looks as good as it works.

Tom Stanton is a frequent contributor to PC Magazine.

# FINALLY!

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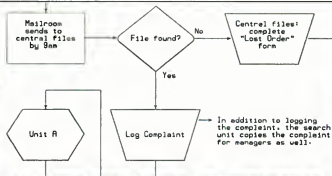
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# MAKING CONNECTIONS

## Univation's LifeNet



As the first to introduce a high-end network operating system that uses database server technology, Univation hopes to crack the market dominated by Novell, 3Com, and Banyan. But does this technology stack up where it counts—in performance?

FRANK J. DERFLER, JR.,  
ROBERTO RIVERA,  
AND RICHARD HUBBARD

U

nivation's

*LifeNet* breaks new ground by being the first high-end network operating system to offer database service. This full-featured system also provides system fault tolerance, an advanced feature that, besides *LifeNet*, only Novell's *System Fault Tolerant NetWare* offers so far.

It is because of its database service capability that Univation markets *LifeNet* as a third-generation network operating system. The first generation of network operating systems, called disk servers, are generally defined as systems offering simple file transfer and equipment sharing. Second-generation systems, which are referred to as file servers, offer file and record locking in addition to these features. Third-generation systems offer all the features of the others and are de-

signed to maximize database performance by distributing the processing load between workstations and servers.

In coming up with a product that has these capabilities, the company is clearly trying to win a share of the high-end operating system marketplace currently dominated by Novell's *Advanced NetWare*, 3Com's *3+Share*, and Banyan's *VINES*. All of these high-end systems share a dependence on dedicated file servers that run under proprietary operating systems. They respond to DOS calls from the operating systems running on the network workstations and use various techniques to improve performance. And all of these companies have announced versions of their products that will offer database service.

To test the performance of Univation's new operating



system, PC Labs benchmark-tested *LifeNet* running on Univation's hardware, which included a LifeServer 386 file server and LifeLink Ethernet network interface cards installed on the network stations. For \$2,695, you can get a LifeNet Starter Kit that includes enough hardware, cabling, and software to equip three workstations. Univation also sells versions of *LifeNet* that can run on network interface cards from Corvus (Omnet), IBM (PC Network and Token-Ring Network), Sytek, and Standard Microsystems (ARCnet). But despite its new technology, the product tested much slower than these other systems.

**SERVING A DATABASE** When you request a certain operation from the DBMS running under a traditional (second-generation) LAN operating system, the system tells DOS to break your file into chunks, and hauls a single chunk from the server over the network to the workstation, which then processes it in RAM, copies it back onto the server, and fetches the next chunk. This method of operation creates a great deal of overhead activity in the network and slows down all users.

The theory behind *LifeNet's* database service is that it minimizes disk input/output and network traffic, which is the primary bottleneck in LAN DBMS operations. By doing so, it improves system performance. In addition, because most of a file server's activity centers around disk I/O, plenty of RAM and processing power remain for database processing tasks, particularly in 68000 and 80386 systems.

The database server works the following way. Rather than requiring the DBMS application on the workstation to do all the work, the database server processes certain DBMS requests on the central file server. To do this, the DBMS application must be broken into two parts. The major portion of the application runs on the workstation just as it does in today's systems, but a separate module runs on the database server. This module then uses the server's RAM and processor to perform certain operations. When such an operation is completed, the server transfers the results to the local workstation(s).

The database server approach offers at least three advantages: greater speed as a

result of fewer I/O actions and file transfers, improved efficiency because files and records are locked for a shorter time, and reduced chance of corrupting data during data transfers.

The drawback is that you need a special version of the DBMS software. Univation announced joint plans with Raima Corp. to host db\_Vista on the LifeServer 386 database server. WordTech and Univation have also announced that the *dbXL* and *Quicksilver* database products will be available in versions compatible with *LifeNet*. At the time this article was written, the version of *DataFlex* that will support *LifeNet* was due for release in December of 1987; *dbXL*, in January of 1988. Since no standard has emerged, you'll need to make sure that both the network operating system you choose and the DBMS integrated with it meet your needs.

**THE TEST SYSTEM** The LifeServer 386, upon which we ran our benchmark tests, is an Intel 80386-based 16-MHz file and database server. The packaging and the information reported by the BIOS indicate that this machine is a relabeled TeleVideo 80386 system.

The LifeServer comes with eight expansion slots (three of which are used), a 1.2MB 5¼-inch floppy disk drive, an internal tape backup unit, a front and back keyboard connector, an RS-232 serial port, a parallel port, 640K of base memory, and 1,024K (configurable to up to 16-MB) of expanded memory. The eight slots consist of one 8-bit, five 16-bit, and two 32-bit slots. The three slots used on the LifeServer are for the video board, the floppy/hard disk drive controller board, and the serial/parallel port with expansion RAM. Our LifeServer was delivered with the network operating system software installed.

To install the half-size LifeLink Ethernet interface cards on the workstations, you just plug them into one of the 8-bit slots of an IBM PC, XT, AT, or compatible computer and connect them with T-connectors and thin Ethernet cables. The card is factory-set for the standard thin-wire Ethernet connection with BNC connectors. You can also connect it to a 15-pin D-conector by changing a jumper setting on the interface card. The documentation



## The Connectivity Decision Guide

This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

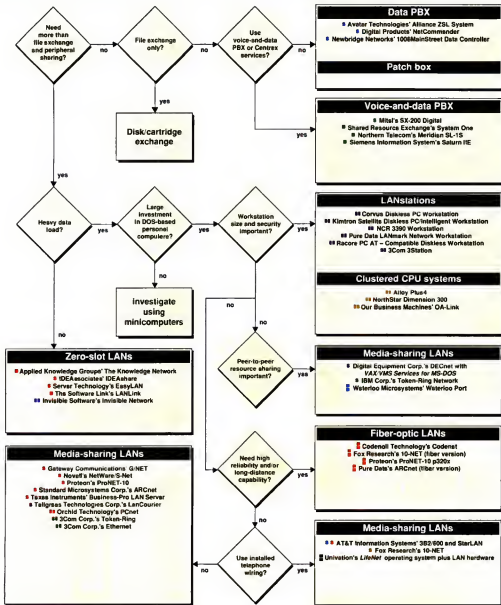
Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

Reviews originally appeared in *PC Magazine*:

- December 9, 1986
- December 23, 1986
- January 13, 1987
- January 27, 1987
- February 10, 1987
- February 24, 1987
- March 31, 1987
- April 14, 1987
- May 26, 1987
- June 9, 1987
- June 23, 1987
- July 1987
- August 1987
- September 29, 1987
- October 27, 1987
- January 12, 1988
- January 26, 1988
- February 16, 1988

Black marker indicates current issue.









## Benchmark Tests: LifeNet

Although these overall benchmark tests show that the LifeNet configuration is slower than the other high-end systems tested here, they mask the fact that LifeNet speeds reads sequential files, as you can see in the detail of the test results shown at right. Because our tests read and write both sequentially and randomly, like networks in most situations do, LifeNet turns out poor average performance times. It is likely that in its specialized database server role, LifeNet's performance will improve. However, the improvement would have to be substantial to make it competitive with the other operating systems LifeNet is positioned against.

### Network Speed Under Load Performance Times

(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
Univation LifeServer 386	LifeLink Ethernet	LifeNet	560	878	2,568	2,915	3,263
Banyan DTS DeskTop Server	EtherLink	VINES	479	780	1,067	1,335	1,603
3Com 3Server3	EtherLink	3 + Share	308	432	529	651	761
8-MHz IBM PC AT	EtherLink	Advanced NetWare/286	264	280	301	310	322

### Hard Disk Access Load Performance Times

(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
Univation LifeServer 386	LifeLink Ethernet	LifeNet	264	878	1,050	1,500	2,013
Banyan DTS DeskTop Server	EtherLink	VINES	218	512	721	2,256	4,331
3Com 3Server3	EtherLink	3 + Share	155	227	330	419	522
8-MHz IBM PC AT	EtherLink	Advanced NetWare/286	136	150	162	174	182

### Database Load Performance Times

(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
Univation LifeServer 386	LifeLink Ethernet	LifeNet	264	712	938	987	1,223
Banyan DTS DeskTop Server	EtherLink	VINES	218	422	520	812	722
3Com 3Server3	EtherLink	3 + Share	155	298	425	585	669
8-MHz IBM PC AT	EtherLink	Advanced NetWare/286	136	189	212	280	305

The PC Labs LAN benchmark tests are written in C and are independent of commercial software. We ran the tests on a test-bed of four 8-MHz IBM PC ATs. For our test-bed to better simulate the conditions on a medium-size network of 20 or more workstations, we designed these loading tests so that a single station represents five to ten times the load of a user performing an interactive task (for example, updating records) on a network. By themselves, the elapsed times reported in these tests are not meaningful. They are valuable only when used to compare the performances of two or more systems running

### A Detailed Look at the LifeNet Test Results

These figures show a portion of the individual test results that make up the number you see on the benchmark table for the four-station load on the Hard Disk Access Load test. In particular, these figures show

the times for the Sequential Read, Sequential Write, Random Read, and Random Write for a 500K file using 16K records. The server is loaded by four stations reading and writing 10K file blocks sequentially to and from separate files.

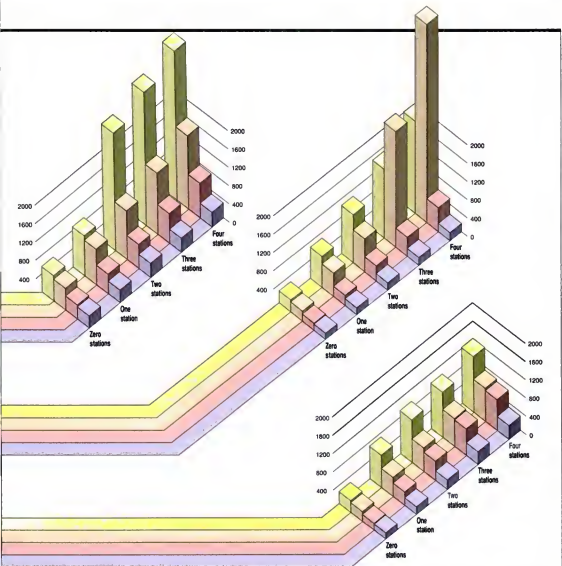
#### Performance Times (Times given in seconds)

Server	Interface card	Software	Sequential Read	Sequential Write	Random Read	Random Write
Univation LifeServer 386	LifeLink Ethernet	LifeNet	10	167	57	174
Banyan DTS DeskTop Server	EtherLink	VINES	10	13	8	17
3Com 3Server3	EtherLink	3 + Share	14	12	13	12
8-MHz IBM PC AT	EtherLink	Advanced NetWare/286	10	9	12	12

under near-identical conditions. Accordingly, we include the tests run on our Editor's Choice configuration of a 3Com 3Server3, 3 + Share software, and EtherLink interface cards to provide a point of comparison. We also show results from a network of Novell's Advanced NetWare/286, EtherLink cards, and an IBM PC AT as the server. Advanced NetWare is our Editor's Choice for networking software, and our tested configuration is a typical one. We also show the results for another comparable system from Banyan, running on a DTS DeskTop Server with EtherLink networking cards and VINES software.

The Network Speed Under Load and the Hard Disk Access Load benchmark tests measure the time needed to perform a standardized task on the network. While the actual work loads used for these two tests (described above) are different, we used the same procedures for both. To obtain the elapsed times shown here, we ran a benchmark program performing a sequential create, a sequential read, a sequential write, a random read, and a random write of a large file. The record size used in these activities systematically rotate between 16K, 4K, and 512 bytes. The numbers shown in the three-dimensional chart are the total time





necessary for all of these operations. We ran the test on all our ATs to load the network while timing just one of them. We then reduced the number of workstations one at a time to show the effect of loading on the network.

This **Network Speed Under Load** test puts a heavy load on the network interface (cards, media, and so forth) while placing a minimal load on the hard disk by having each station continuously read and write its own 1-byte data file, changing the data each time. For systems with disk caching, the load on the hard disk is even smaller, since cached

systems typically perform a disk write but do not require a physical disk read.

The **Hard Disk Access Load** test heavily loads the hard disk and disk-caching system. To do this, each station randomly accesses its own 100K data file using 1K records. Data written to the file is changed each time. The random reads typically access data outside the cache, which forces a disk read, as does any write.

The **Database Load** test exercises the system's record-

locking support and the way it handles a number of random simultaneous accesses to a common file. This test times how fast each loading station accesses a common database consisting of an index and a data file. Half the accesses are simple searches of the index file and an accompanying access to a record in the data file. One quarter of the accesses perform the same operation but also lock the data record and update its contents. The remaining accesses update the index file and a data record. The index file is locked during every update and the DOS 3.1 FLOCK statement prevents simultaneous index file updates.



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### Webster's New World Writer 1.04 .....

- 59.

### Softlogic Solutions ... NCP

- Software Carousel 2.0 (everything resident) ..... 35. |

- Disk Optimizer 3.0 ..... 35. |

For the IBM-PC (XT & AT) Exclusively.

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## Software Publishing ... NCP

■PFS:First Publisher 1.0	\$59
■PFS:First Choice 2.0	89
■PFS:Professional Write 1.03	119
■PFS:Professional File 1.01	149
■Harvard Graphics 2.0	239

## Springboard ... NCP

NewsroomPro	45
Symantec ... NCP	
□Q & A 2.0 (database, word processor)	209
■Q & A Write 1.0	119

## Travelling Software ... NCP

■LAP-LINK 2.0 (5 1/4" to 3 1/2" and back)	79
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## True BASIC, Inc. ... NCP

□True BASIC 2.01	59
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## Turner Hall ... NCP

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## Vericom ... NCP

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■SQZIt! Plus 1.0 (make 1-2-3 sheets smaller)	59
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■WordPerfect 1.0 (add word processing to 1-2-3)	59
■Cambridge Spreadsheet Analyst 2.02	59

## WordPerfect Corp. ... NCP

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■WordPerfect Executive 1.0	119
□WordPerfect 4.2 (one of the best)	199

## WordTech Systems ... NCP

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### Microprose ... CP

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Silent Service (requires CGA)	22
Gunship (requires CGA or EGA)	32

### Microsoft ... CP

□Flight Simulator 2.13 (reqs. graphics brd.)	32
----------------------------------------------	----

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Falcon (F-16 simulation, requires CGA)	32

### Sublogic ... NCP

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### XOR ... NCP

□NFL Challenge	69
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### PC Connection

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Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

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(now upgrades to 576k)	129
SoxPakPremium 256k C/S/P	
(upgrades to 1 Meg or 2 Meg w/Piggyback)	199.
Advantage Premium 512k S/P	
(upgrades to 1 Meg or 2 Meg w/Piggyback)	299.
RAMpage! 286 512k (upgrades to 2 Meg)	339.
RAMpage! 2 64k (upgrades to 2 Meg)	209.
Hot Spot 286 (10 Mhz)	379.
AST Premium series boards and RAMpage! boards support EMS and fully support EEMS.	

### Amdisk ... 1 year

LaserDrive-1 (CD-ROM Drive; 90-day wrty)	629.
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Video 410A (amber monochrome monitor)	159.

### Compucable ... 2 years

2-Position switch box	29.
3-Position switch box	39.

### Cuesta ... 1 year

Datavser 200 Watt (PC backup power unit)	339.
Datavser 400 Watt (AT backup power unit)	459.

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ACCESSORIES	
Disk Holder DB-1 (holds 50 5 1/4" disks)	8.
Printer Stand PS-1	18.
Universal System Stand SS-3	25.

### CABLES

Smartmodem-to-PC Cable (9 feet)	17.
Printer-to-IBM cable (9 feet)	17.

### SURGE SUPPRESSORS

Safesnap SP-3 (6 outlets, 1 year wrty)	21.
Diamond SP-1 (6 outlets)	32.

Ruby (6 outlets; EMVFI filtered; 6 ft cord)	59.
Ruby-Plus (w/FAX & modem protection)	69.

### DCA ... 1 year

Irma 2 (3270 emulation board)	729.
Irma PS/2 (for Models 50 and 60)	729.

### Epson ... 1 year

All cps speeds listed are for 12 cps mode	
EX-800 printer (80 column, 300 cps)	call
EX-1000 printer (136 column, 300 cps)	call
FX-86e printer (80 column, 240 cps)	call
FX-286e (136 column, 240 cps)	call
LQ-850 printer (80 column, 264 cps)	call
LQ-1050 printer (136 column, 264 cps)	call
LQ-2500 printer (136 column, 324 cps)	call
LX-800 printer (80 column, 180 cps)	call
Printer-to-IBM cable (6 feet)	15.

### 5th Generation ... 6 months

Logical Connection 256k	319.
Logical Connection 512k	379.

### Hayes ... 2 years

Smartmodem 1200	299.
Smartmodem 1200B (with Smartcom II)	299.

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Smartmodem 1200B (no software) . . . . .	\$265.
Smartmodem 2400 . . . . .	449.
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<b>Hercules ... 2 years</b>	
Hercules Color Card (CGA) . . . . .	159.
Hercules Graphics Card Plus . . . . .	189.
Hercules Incisor Card (includes RAMfont) . . . . .	call
<b>IMSI ... lifetime</b>	
Optmouse (includes Dr. Halo II) . . . . .	99.
<b>Intel ... 5 years</b>	
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Inboard 386/AT (req. installation kit) . . . . .	949.
Inboard Installation Kit (specify computer) . . . . .	139.
Aboveboard 286 512k . . . . .	319.
Aboveboard PS/286 512k S/P . . . . .	349.
AboveBoard 2 . . . . .	special
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80287 (for IBM PC & XT 286) . . . . .	195.
80287-8 (for 8 MHz 80286 machines) . . . . .	249.
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101 Keyboard (enhanced layout) . . . . .	99.
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<b>Microsoft ... 1 year</b>	
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Mouse with Easy CAD (specify bus or serial) . . . . .	119.
<b>Migent ... 1 year</b>	
Pocket Modem (ext., 1200 baud, w/8tcom) . . . . .	169.
<b>MSC Technologies ... lifetime</b>	
PC Mouse (serial version) . . . . .	99.
PC Mouse (bus version) . . . . .	109.
<b>NEC ... 2 years</b>	
Multisync II (800 x 560 max. res.) . . . . .	579.
Multisync Plus (968 x 750 max. res.) . . . . .	949.
<b>NSI Logic ... 3 years</b>	
Epic 480 (extended EGA) . . . . .	129.
Smart EGA Plus (supports 800x600 res.) . . . . .	269.
<b>Oldgate ... 1 year</b>	
Laserline 6 . . . . .	call
Laserline 6 RAM cartridge (384k) . . . . .	239.
Personality Module (specify ser. or par.) . . . . .	159.
Toner Cartridge . . . . .	23.
<b>Orchid Technologies ... 2 years</b>	
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PC Turbo 286 w/1 Meg (10 MHz) . . . . .	729.
Jet 386 (includes cable kit) . . . . .	869.
RAMquest 2 Meg (for PS/2 models 50160) . . . . .	699.
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Microbutter Mini (parallel print buffer w/128k) . . . . .	85.
Microbutter Inline (par. print buffer w/256k) . . . . .	169.
1200 Baud Internal Modem (w/ProComm) . . . . .	89.
1200 Baud External Modem . . . . .	109.
2400 Baud Internal Modem (w/ProComm) . . . . .	159.
2400 Baud External Modem . . . . .	189.
<b>Princeton Graphics ... 1 year</b>	
MAX-12E (amber monochrome monitor) . . . . .	139.
HX-12E (640 x 360 max. res.) . . . . .	499.
Ultrasync (supports CGA, EGA, VGA) . . . . .	529.

<b>Quadram ... 2 years</b>	
ProSync (with mouse; supports 640x480 & 752x410 resolution) . . . . .	\$259.
Microtazer II Print Buffer 64k . . . . .	249.
Ultra VGA . . . . .	319.
<b>Toshiba ... 1 year</b>	
P321SL printer (80 col., 216 cps, w/tractor) . . . . .	529.
T1000 Laptop (80C88, 6.4 lbs., 5 hr. battery) . . . . .	call
T1200 Laptop (80C86, 10 MHz, 20 Meg) . . . . .	call
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<b>Tseng Labs ... 1 year</b>	
EVA 480 (supports 640x480 resolution) . . . . .	299.
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VEGA Deluxe (supports 640x480) . . . . .	249.
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<b>IOmega ... 1 year</b>	
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10 Meg cartridge . . . . .	59.
Bernoulli Box 40 Meg w/PC2 card . . . . .	1849.
20 Meg cartridge . . . . .	82.
Bernoulli II (single 20 Meg internal) . . . . .	949.
<b>Microscribe Corp. ... 1 year</b>	
ScribeCard 30 Meg (68 ms) . . . . .	479.
<b>Mountain Computer ... 1 year</b>	
40 Meg Internal Tape Drive (XT or AT) . . . . .	379.
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<b>Plus Development ... 2 years</b>	
Hardcard 20 Meg (49 ms) . . . . .	call
Hardcard 40 Meg (39 ms) . . . . .	call
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<b>FREE PCTV® Hard Drive Installation Tape with the purchase of Seagate drive for the IBM PC (not for AT). Specify Beta or VHS.</b>	
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<b>Toshiba ... 1 year</b>	
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## MEMORY

64k Upgrade Set (150 ns, set of 9) . . . . .	call
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Fuji MD2HD (10 disks per box) . . . . .	22.
Sony (10 disks per box) . . . . .	23.
Maxell MD2-HDM (10 disks per box) . . . . .	23.
Verbatim DataLife (10 disks per box) . . . . .	22.
<b>3 1/2" DS/DD Diskettes (720k)</b>	
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Fuji (10 disks per box) . . . . .	19.
Maxell (10 disks per box) . . . . .	20.
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Maxell (10 disks per box) . . . . .	59.

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Grieler's OnLine Encyclopedia . . . . .	32.
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PC Connection Computer Toolkit . . . . .	22.

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  - For all other items, add \$2 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd Day-Air at no extra charge if you are more than 2 days from us by UPS ground.
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## ■ UNIVATION'S LIFENET

for the installation and configuration of the interface card gives step-by-step instructions, illustrated by charts and diagrams.

Installing the software on the workstations requires DOS 2.0 or later. Each interface card comes with a menu-driven Setup utility that copies all of the required system files and defines the DOS environment statements for the workstation.

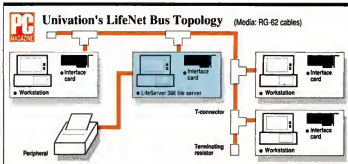
### USING LIFENET SOFTWARE

The *LifeNet* software offers connectivity in a variety of shapes and sizes. Its naming feature allows you to build a network with hundreds of servers. In addition, like Novell's *Advanced NetWare* and Banyan's *VINES*, *LifeNet* allows you to place up to eight different types of interface boards in the same file server. Since you can attach a network of PCs to each of these cards, you can connect up to eight networks with the same file server. Looking to the future, Univation could easily adapt *LifeNet* to run on minicomputers or other hardware systems because it is written in the C programming language.

*LifeNet* supports a maximum server disk capacity of 400 gigabytes and a maximum single-file size of 4 gigabytes. The operating system can run in a server with only 640K of memory. The software uses a technique called elevator seeking to optimize the movement of the heads on the hard disk drives. Elevator seeking, which is also used on Novell systems, means that when the heads of the hard disk drives move in response to requests for data, they move in the most logical order, rather than responding in the order that the requests were received.

According to Univation, *LifeNet* stores files in an index-sequential manner, which means that data is automatically indexed and that index notes in a special file aid in the retrieval of data and in recovery from damage.

The system offers on-line pop-up help, a phone-messaging system, and a calendaring system. *LifeNet* also allows you to remotely access the system through an RS-232C connection on the server (usually for a modem). A remote user has all the same privileges and can access the same devices as a local user. The only difference between the two is that a remote user's requests to the server go through the tele-



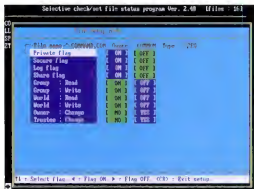
Univation's *LifeNet* networking software can run on a variety of media and network interface cards. The system we tested (below) used Ethernet RG-62 cable and interface cards and an 80386 network server. The server is dedicated to that role, and network-shared peripherals are attached to it. The system uses the CSMA (carrier sense multiple access) listen-before-transmit media-sharing protocol on a bus-wiring configuration.



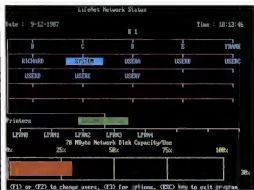


## ADMINISTERING THE NETWORK

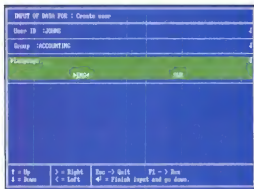
*LifeNet is laden with tools and menus that simplify the life of the system administrator. The screens shown here represent just a few of them.*



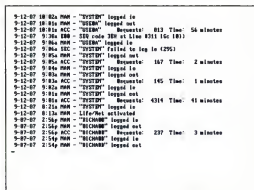
The file status program is an operational tool for the network administrator. It shows various file attributes, including the file's flag for special handling by the operating system, security protection, whether the file is to be logged, and whether it can be shared among various users.



This Network Status screen shows the current users, their IDs, and other features such as the configuration of network printers and statistics about the shared disk drives.



The network administrator uses this screen to authorize users in LifeNet. Adding users is an easier task with LifeNet than it is with many other systems. The language selection allows the administrator to assign various character sets to workstation users.



This listing of the system log shows transactions for specifically flagged files. This log file can be used to update files in the event of a major failure or to trace actions that crashed the system.



## ■ UNIVATION'S LIFENET

phone lines and thus have a slower response time.

The on-line help is RAM resident, and the user can load or unload it. The help system is not context-sensitive and is grouped into screens of contiguous text, making it cumbersome to read.

**TUTORIAL MAKER** A utility called the Tutorial Maker allows you to create self-running tutorials for any application running under MS-DOS and *LifeNet*. The Tutorial Maker records and replays keystrokes and runs programs under its control. You can add comments to screens, explaining what the users see.

The Phone Message system is a basic electronic mail system that allows you to send messages to anyone on the network. Each user is assigned a unique two-letter logical code as a mailbox address. The system stores incoming messages in each user's private mailbox. The only enhancement to this basic messaging system is that the sender can tell the system to send the message before or after a specified time.

Like the on-line help and the Calendar system, the Phone Message system is RAM resident. Pressing the Alt-F2 key sequence calls up the Phone Message system, and pressing the Alt-F3 key sequence calls up the Calendar system—in the mid-

you'll have to maintain and update appointments on the network. The system is efficient and doesn't require much time to use, so it can be a powerful organizing tool for work groups.

The system includes a System Manager menu for system administrators. From this menu, the system administrator can update the central system, create/modify each user's start-up file, check network and file status, add/delete users, and perform system housecleaning.

In addition, *LifeNet* supplies a number of tools for the system administrator. The *LifeNet* Network Status system gives a real-time, visual status display with information about the users, the print queue, and disk usage. *LifeNet* comes with utilities to display disk assignments, to set and review file attributes, to convert word processing files to *LifeNet* Helpmenu files, and to display logical drive assignments.

*LifeNet*'s security features are excellent. While they are somewhat complicated to set up and use, they allow the network administrator to password-protect single files, hide directories from categories of users, and even protect access to the floppy disk drive on the server. The ability to assign users to groups with specific rights and privileges makes routine password and access-right changes easy.

### FAULT-TOLERANT OPERATION

The *LifeNet* System Log utility copies each transaction to tape, providing a degree of fault tolerance in case of breakdown and helping the administrator monitor the system. When the administrator sets a log flag on a file, any transaction written to the file is archived on the server's tape log. Files suitable for logging are those that many users access simultaneously. Since it's difficult to know the best time to back up these files, you can use tape logging for dynamic and continuous backups. If the system fails, you can use the tape to reconstruct the changes to the files. The tape can also help you find the reason for a crash.

Our tests of this system consisted of installing the network interface cards, loading the network operating system into the workstations, and spending several days using the utilities and running the PC Labs LAN benchmark tests. Unfortunately we did not have the opportunity to use *LifeNet*

with any of its associated database products, since final versions of these products were not yet available. We were also unable to use or evaluate what appear to be significant capabilities available in the system to communicate with other computers using IBM 3270 protocols and the TCP/IP higher-level protocols.

While we didn't wring out this system as thoroughly as a large installation might over months of operation, we believe that our findings are significant. Despite its use of a server with a 16-MHz 80386 processor and relatively fast Ethernet interconnection, *LifeNet* did not perform as well as other products in the market Univation wants to penetrate. The program has flexibility and some unique features, but the PC Labs benchmark test results show that it is much slower than other Ethernet-based alternatives, such as Novell's *NetWare*, Banyan's *VINES*, or 3Com's *3+Share*.

Each number reported in PC Labs

■ *LifeNet* offers a basic e-mail system that allows you to send messages to anyone on the network.

dle of any application. You can change the hotkey combination if it conflicts with your application.

*LifeCal*, *LifeNet*'s electronic pop-up appointment system, is an alternative to the traditional pocket calendar. *LifeCal* lets you set up and change appointments, as well as review your schedule. You can check your daily, weekly, or monthly schedule, query appointments by date and time, and produce a printed listing of the day's appointments. But to do all this,



## FACT FILE

### *LifeNet*

Univation  
638 Gibraltar Ct.  
Malpas, CA 95035  
(408) 263-1200

Workstation Requirements: 50K RAM,  
one disk drive, DOS 2.0 or later.

Server Requirements: 640K RAM, hard  
disk drive, IBM PC AT or 80386-based  
computer.

List Price: *LifeNet* software, \$1,495; *LifeLink* Ethernet interface card, \$395; *LifeLink* Ethernet interface card with TCP/Link driver, \$595; *LifeLink* Ethernet interface card with TCP/Link driver and TCP/Link software, \$695; *LifeNet* Starter Kit, including *LifeNet* software, three *LifeLink* Ethernet interface cards, three T-connectors, two 50-foot Ethernet cables, two terminations, and user manual, \$2,695; *LifeServer* 386 with 75MB, \$10,595; *LifeServer* 386 with 150MB, \$14,195.

In Short: *LifeNet* is a LAN operating system that can be used on Univation's line of servers and Ethernet cards or on the computers and networking hardware of other companies. It has many built-in features, one of which—its DBMS service—is found on no other currently available system. However, the system's response time is much slower than that of competing products. Not copy protected.

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## ■ UNIVATION'S LIFENET

benchmark tests represents the sum of a number of tests that includes a sequential create, a sequential read, a sequential write, a random read, and a random write of several files. In the benchmark test chart, we show you some of the numbers that were added together to make a single point or bar in the benchmark test. (The point chosen doesn't matter as much as the data it shows.) This close examination of our data showed that *LifeNet* responds quickly to requests for data read sequentially from a file, almost without regard for the size of the blocks used to withdraw the data. But it does slow down considerably when data is written or read randomly.

■ *LifeCal*, *LifeNet*'s electronic pop-up appointment system, is an alternative to the traditional pocket calendar.

Therefore, while the *LifeNet* system is competitive in retrieving data under some conditions, it falls far behind when performing random reads or writes. We are sure that adjusting buffers and caching will improve network performance, but none of these networks were specifically "tuned" for the tests.

**BOTTOM LINE** *LifeNet* is a sound network operating system that is easy to use, rich in features, and laden with tools for the system administrator. It is slightly less expensive than alternative systems. Despite its advanced features, *LifeNet* doesn't have the speed associated with the premium network operating systems that Univation positions itself against.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine. Roberto Rivera is a member of the LAN evaluation team and a frequent contributor to PC Magazine. Richard Hubbard is a student majoring in Information Science at George Mason University.

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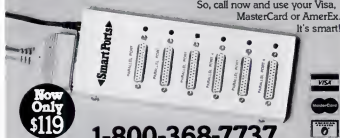
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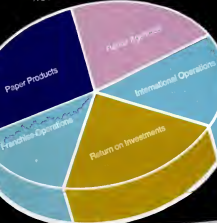
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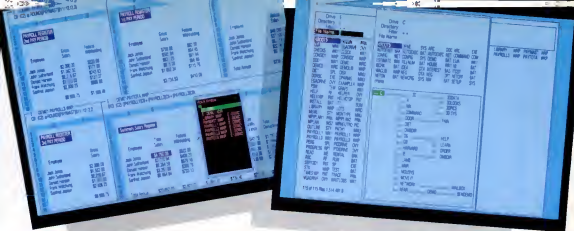
COMBINED ANALYSIS  
A SURPASS DEMONSTRATION



ITEM	SURPASS	LOTUS 1-2-3	QUATTRO	EXCEL
Hot Links in Formulas	✓	NO	NO	✓
Hot Links in Commands	✓	NO	NO	✓
Hot Links in Macros	✓	NO	NO	✓
Hot Links to Unloaded Files	✓	NO	NO	NO
Hot Links in Extended POINT Mode	✓	NO	NO	NO
View Multiple Spreadsheets in Multiple Windows	✓	NO	NO	✓
Macro Recorder	✓	NO	NO	✓
Macro Library	✓	NO	NO	✓
Macro Multiple Window Access	✓	NO	NO	✓
Macro Single Step Macro Debugging Environment	✓	NO	✓	NO
Column Adjustment by Range	✓	NO	NO	NO
Column Adjustment - Automatic	✓	NO	NO	NO
80286 / 386 Version Included	✓	NO	NO	✓
8086 Version Included	✓	✓	✓	NO
Operation is 512K RAM	✓	✓	✓	NO

SURPASS™ is the next generation spreadsheet combining multiple worksheets in windows with *Hot Links*™ between work-sheets. Hot Links can be used as a natural part of every operation including range name specification, macro notation and Extended POINT mode operations. A Macro Keystroke Recorder function, Macro Trace function, Macro Library Capability, and enhanced macro commands allow anyone to create powerful macros that can operate on a single worksheet and on a collection of worksheets. SURPASS' Dependency-Based Recalculation and Background Recalculation give it the performance needed to tackle a new generation of spreadsheet applications. SURPASS has Advanced Consolidation Graphics utilizing multiple data sources for





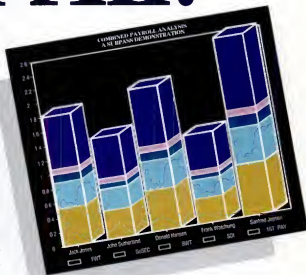
# Them All!

## Software features:

ITEM	SURPASS	LOTUS 1-2-3	QUATTRO	EXCEL
Graphics — 3-D Effects	✓	NO	✓	✓
Graphics — Presentation Quality	✓	NO	NO	✓
Graphics — Integrated Printing	✓	NO	✓	✓
Graphics — On-Screen Fonts	✓	NO	✓	✓
Graphics — Full Customization	✓	NO	✓	✓
Graphics — Compare Data from Multiple Worksheets in a Single Graph	✓	NO	NO	✓
Minimal Recalc	✓	NO	✓	✓
Background Recalc	✓	NO	NO	✓
Single Keystroke Undo	✓	NO	NO	✓
100% 1-2-3 Compatible	✓	✓	✓	NO
Network Support (LAN)	✓	NO	NO	✓
CGA Support	✓	✓	✓	NO
Ability to Create WKS, WK1 Files	✓	NO	NO	NO
Visual Manager	✓	NO	NO	NO
Price	\$495	\$495	\$195	\$495

\* Limited

comparison graphics generation. A full UNDO capability and sophisticated Visual File Manager allow the user to manage the expanded work environment as an integral part of SURPASS. Intuitive pull-down menus tie the new features into the 1-2-3™ interface. A subset of SURPASS' capabilities implements 100% of 1-2-3 keystrokes, file structures, macros, commands, functions and formulas (version 1.0, 2.0 and 2.01). Keystroke Recorder, Automatic Column Range Width Adjustment, Worksheet Find, Slide-Show, Hot Links Consolidation, Comprehensive Network Capability (LAN) and enhanced EMS Memory Support add further to the rich set of features. Surpass is also available in a 286/386 optimized version for reduced memory and higher speed performance.



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# KEYBOARD CALCULATIONS FOR THE PC

**W**hy buy software to turn your \$3,000 PC into a \$200 calculator? If you want to add this capability to your PC, why not just buy a calculator and a strip of Velcro?

This was our initial response to software packages from Eclipse Logic, StraightForward, K Software House, and Popular Programs that purport to emulate calculators made by Hewlett-Packard. After investigating the products, though, we realized that the matter wasn't quite so simple. While they faithfully mimic a calculator's functions, these programs also give you access to disk drives, full screen displays, and vast amounts of memory to provide capabilities that the lowly calculator should not hope to match—often for about half the price of their hardware counterparts.

**POCKET CALCULATORS** Hewlett-Packard created the scientific calculator market with the venerable HP35. It was expensive and nonprogrammable, and its functions are paltry by today's standards, but when introduced in 1972, it seemed like a piece of wizardry. Not only was the HP35 the first scientific calculator that would fit in your pocket, but it also had two other remarkable characteristics that were to become HP hallmarks.

The first was sturdiness. Stories abound of falls and collisions withstood by the HP35. Hewlett-Packard may have changed the workings of its calculator several times over the years, but it has never skimped on the quality of the construction.

The second notable feature was HP's departure from the normal algebraic syntax used by all other calculator manufac-

ture, even today. It opted for Reverse Polish Notation, a syntax that changes the conventional order in which numbers and operators are entered (see the sidebar "Reverse Polish Notation"). For first-time users of an HP, the question is always the same: "Where is the equal sign?" But once they've gotten used to it, many become devotees of this strange but powerful syntax used by the HP calculator line.

Driven out of the low-end market recently by low-cost imports, HP has taken the high road. Its product range stretches from the merely powerful to the incredible. The Hewlett-Packard 11C scientific calculator and 12C financial calculator represent the lower reaches of the Hewlett-Packard line. While they're certainly capable, their powers do not elicit the gasps of astonishment prompted by their larger sib-

*Priced from \$49.95 to \$115, these five TSRs—the ELI-41, the HP41E, the KSH-1 and KSH-2, and the PC-12C—put the power of Hewlett-Packard calculators at your fingertips.*



## ■ HP CALCULATOR EMULATORS



### HP Calculator Emulators: Summary of Features

(Products listed in ascending price order)

Programs that emulate Hewlett-Packard calculators typically emulate the HP12C, a financial calculator, or the HP41C, a scientific calculator. The features of *KSH-1*, however, more closely approximate those of the HP11C than those of the HP12C, and the features of *KSH-2* more closely approx-

imate those of the HP38C scientific calculator than those of the HP41C. The software packages typically sell for less than the actual calculators and, because they use the resources of the PC, they may be more powerful.

#### HP Calculators

#### HP Calculator Emulator Programs



ELI-41  
Professional  
Scientific  
Calculator  
Software  
\$99.95

#### FEATURES

	HP12C \$99.00	HP41C \$249.00	KSH-1 \$49.95	KSH-2 \$69.95	PC-12C \$69.95	ELI-41 Professional Scientific Calculator Software \$99.95	HP41E \$115.00*
User-selectable hotkey	N/A	N/A	●	●	●	○	○
On-line help	N/A	N/A	●	●	●	○	●
Advanced program editor	N/A	N/A	○	○	Not program- mable	●	○
No. of program steps	<100 <sup>1</sup>	Varies <sup>1</sup>	<512 <sup>1</sup>	<512 <sup>1</sup>	0	300	16,000
No. of memory locations	<20	<320	20	20	20	500	320
Emulation	N/A	N/A	HP11C	HP38C	HP12C	HP41C	HP41C
Accepts ASCII program files	N/A	N/A	○	○	○	●	○

#### IMPORT/EXPORT CAPABILITY

Imports single value	N/A	N/A	●	●	○	●	○
Imports multiple values	N/A	N/A	●	●	○	○	○
Export	N/A	N/A	●	●	●	●	○

● — Indicates Editor's Choice. ● — Yes ○ — No <sup>1</sup>Includes 8087 version. <sup>2</sup>The HP calculators can trade memory locations for program size anywhere between 20 registers with only 8 program locations to 7 registers with 100 program locations. <sup>3</sup>KSH-1 and KSH-2 allocate 1,024 bytes for program storage. The actual number of instructions depends on the size of the actual instructions used. N/A — Not applicable; applies to emulator programs only.

lings—but then neither do their prices. K Software House's *KSH-1* emulates the HP11C, and its *KSH-2* emulates the HP12C.

StraightForward's *Buttons* (HP41E) and Eclipse Logic's *ELI-41 Professional Scientific Calculator Software* mimic the Hewlett-Packard 41C Scientific/Engineering calculator, which is truly the Cadillac of the field. Almost every function known to science is beneath one of its keys—and you can add any that aren't by means of an optional module for one of its four expansion ports. The HP41C family also includes printers, optical wands, extended memory modules, a serial interface, a plotter, and even a card reader.

**NEW CALCULATORS** The HP41C is outperformed only by Hewlett-Packard's newest high-end calculators, the HP18C

and the HP28C. The top-of-the-line HP28C features dual keypads in a pocket-book frame with infrared calculator-to-printer interface and boasts 1,150 functions, all menu driven. These calculators have not been around long enough to have the following or the imitations spawned by the older members of the family. It shouldn't be long, though, before they give rise to a new generation of software emulators.

No matter how powerful, a calculator has some fairly severe limitations, the most obvious of which is the display. Even though the HP41C can display ASCII characters, it cannot present more than 11 of them to the user at one time, and then only on a single line. Software calculator emulators have access to the PC's full 25-row by 80-column screen.

The lack of any hard storage is another

limitation suffered by calculators. Hewlett-Packard's models all sport continuous memory, allowing them to retain the contents of memory even when turned off, but it is still awkward to save programs for later use without a disk. Emulators, on the other hand, have access to plenty of disk storage for saving programs.

Finally, there is no direct connection from the calculator to the PC. Transferring data from one to the other manually is a tedious and error-prone exercise. RAM-resident emulators allow automatic transfer of data in both directions.

We evaluated how well each of the five packages under consideration takes advantage of the extra capabilities made available to it by the PC. And, of course, we took a close look to see whether each really does provide all the functions of the calculator it emulates.



## ELI-41 Professional Scientific Calculator Software

*ELI-41 Professional Scientific Calculator Software*, \$99.95 from Eclipse Logic, is the most impressive of the packages tested. Anyone in doubt about what the power of a PC can bring to a calculator should take a look at this one. *ELI-41* does more than just emulate the HP41C calculator. Some of its features actually improve on the original.

*ELI-41* can be executed from the DOS prompt like any other program, or it can be installed as a TSR pop-up. To load the program as a pop-up, however, you must be in the directory that contains the program and its support files—you cannot just set the path to this directory in your AUTOEXEC.BAT file. Once loaded, *ELI-41* may be brought up from within any application by entering Alt+ (opening single quote). Unfortunately, you cannot redefine this hotkey. Even more unfortunate is that when RAM resident, *ELI-41* uses a whopping 123K bytes of RAM space.

Once active, *ELI-41* shows you four displays, one each for the calculator, the flags, the stack, and the registers. The calculator display does its best to mimic what the user of an actual HP41C calculator would see. Eclipse Logic added the other displays to make it easier for the user to keep track of the calculator's internal state.



The *ELI-41* divides your PC screen to show stack and registers alongside a picture of the face of the HP41C scientific calculator.

The flag display is a small matrix of dots and dashes related to the 1 and 0 values of the corresponding flag registers. The stack display allows the user to take in each of the calculator's four stack and Last X values at a glance. The register display provides an overview of the calculator's internal registers. While only 10 of the 500 registers can be displayed at one time, the PgUp and PgDn keys let the user scroll easily through the rest.

**BUSY SCREENS** All of this information initially gives the *ELI-41* screen a busy appearance, which is aggravated by the needless inclusion of the company name, program version, and program serial number. Thanks to the clever use of color, however, I quickly learned where to look for the information I wanted. These extra displays make the *ELI-41* calculator much easier to use than the HP41C itself, with its single display.

Programming is another area in which *ELI-41* outshines its precursor. You can program *ELI-41* either through ASCII files generated by an external text editor or through a key capture mode similar to that used by the HP41C itself. While the ASCII

file method is complicated by special prefix letters that you must add to each command, the key capture method is quite simple. In addition to the HP41C's limited single-step and back-step capability, *ELI-41* has a built-in program screen editor. You can view the entire program at one time and edit any part of it at will. Programs may also be saved to disk for later recall.

*ELI-41* emulates the constant memory feature of the HP41C by letting you save to disk. Unlike the HP41C, *ELI-41* does not do this automatically, so you must remember to save a file before powering down the machine. *ELI-41* also supports most of the library functions available on the HP41C but lacks its stopwatch, alarm, and date/time features.

*ELI-41* does not require an 8087/80287 math coprocessor but will use one if it's present. Like Hewlett-Packard, Eclipse Logic offers several optional packages containing extra routines specific to various fields, such as chemistry, physics, and architecture. In addition, optional support is available from Eclipse Logic for both the HP1B interface bus and the HP41C's HP-IL serial interface.



**EDITOR'S CHOICE**

**FACT FILE**

**ELI-41 Professional Scientific Calculator Software**  
 Eclipse Logic  
 P.O. Box 2003  
 Huntington Park, CA 90255  
 (213) 569-6020

**List Price:** \$99.95  
**Requires:** 256K RAM, one floppy disk drive, DOS 2.0 or later.

**In Short:** A powerful TSR package that emulates the Hewlett-Packard 41C. Its program-editing capabilities and informative displays outshine those of its HP model. Not copy protected.

CIRCLE 66 ON READER SERVICE CARD



## GENERIC CALCULATORS

Not all calculator programs attempt to emulate the hand-held calculators. Some are simply calculator programs designed to run on a PC without any thought toward the kind that have real buttons to push. They won't have all the features designed into their cousins that carry the Hewlett-Packard label, but their manufacturers reason that there is no point in emulating a calculator on a PC.

So if HP power is not what you need, you can find simpler, generic programs that do not deliver much more than the capabilities of a wafer-thin pocket calculator that you can pick up for about \$10. These pop-ups can do simple calculations, but unlike the wafers, they can be called up on your PC at any time. Borland brought us the original memory-resident calculator in *SideKick*, and today every memory-resident desktop organizer worth its salt has at least one buried somewhere within its menus. You'll also find calculators packaged with keyboard macro utilities and desktop tools, as in Polytrom's *PolyDesk III*.

Not all generic calculator programs take the TSR approach, however. Some capitalize on the inherent advantages of a PC, something their hand-held brethren cannot do. Typical of these are Lascaux Graphics' *Lascaux1000* and Advanced Logic Systems' *CloneWare ALS 18C Financial Consultant*.

### ELEGANCE OF CONVERSIONS

The \$59.95 *Lascaux1000* does simple trigonometric functions (sine, cosine, and tangent) and their inverses. What makes *Lascaux1000* unique is its understanding of units. It can solve the following problem: "How many feet will a car traveling 65 miles per hour go in 45 seconds?" A simple problem? Perhaps. Basically, this is a RATE \* TIME problem, the rate being 65 mph and the time set to 45 seconds.

What makes this problem difficult to solve is the number of unit conversions that have to be performed; first from seconds to hours and then miles to feet. With

*Lascaux1000*, the user simply enters "65 mile per hr \* 45 sec =" and, voilà, he gets the answer. *Lascaux1000* makes all necessary unit conversions. Like all brilliant ideas, one wonders why someone hadn't thought of it before.

Users are free to define their own units. If *Lascaux1000* does not know what a furlong is, for example, all you have to do is tell it and save the new definition file to disk for future use. In addition, *Lascaux1000* maintains a dictionary of commonly (and some not-so-commonly) used constants and their units. The user can define new constants or modify existing ones at will.

Since *Lascaux1000* understands units, it can find many calculation errors as they are made. *Lascaux1000* can also manipulate fractions in the event the user

is uncomfortable with decimals. With the program, two and one-half stays 2½ and not 2.5, and it can display fixed decimal and scientific notation, if preferred. However, *Lascaux1000* lacks advanced scientific and business functions and so is not terribly useful to power users.

**MENU ORIENTATION** *CloneWare ALS 18C Financial Consultant*, which lists for \$89.95, takes a completely different approach. The calculator portion of the program is of the four-function variety. However, attached to it is a menu of some 20 common business functions. Unlike normal calculator functions or programs written for a general-purpose calculator, these functions are menu oriented.

This is helpful to absentminded types who, like me, can never remember which values to fill in when computing present-value problems and when to fill in the values. With *ALS 18C*, you can select Present Value from the menu and then simply fill in the blanks without referring to the manual. Go back and change a value, and the calculator just asks which other value you would like it to recalculate.

Input with *ALS 18C* is much more flexible than with most calculator programs. The user can scroll back and forth with the arrow-keys and provide values in any order. A small four-function calculator stands off to the right of the screen in case it is needed to help calculate one of the input values. Output on *ALS 18C* is also more flexible. Some functions generate whole tables of output, including pages of amortization schedules, on the printer.

*ALS 18C* is not programmable and its functions may not be enough to satisfy the power user, but this is far and away the easiest financial calculator to use that I've come across. If you have moderate needs, like deciding if you can afford a new house or if you should buy or lease that new car, this may be for you.

—Stephen Randy Davis



## FACT FILE



**CloneWare ALS 18C**  
*Financial Consultant*  
Advanced Logic  
Systems  
1211 Alderwood Ave.  
Sunnyvale, CA 94089  
(408) 747-1988  
List Price: \$89.95

Requires: 50K RAM, one floppy disk drive, DOS 2.0 or later.

**In Short:** A menu-driven four-function calculator that is nonprogrammable. Limited features, but wonderfully easy to use. Not copy protected.

CIRCLE 636 ON READER SERVICE CARD



**Lascaux1000**  
Lascaux Graphics  
3220 Steuben Ave.  
Barnes, NY 10812  
(212) 654-7429  
List Price: \$59.95 plus  
\$3.00 shipping and  
handling.

Requires: 256K RAM, one floppy disk drive, DOS 2.1 or later.

**In Short:** A sample trigonometric calculator that can automatically convert units of value. Not copy protected.

CIRCLE 634 ON READER SERVICE CARD



# COLORSCAN<sup>®</sup>/2 Workstation

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and PC applications.  
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The COLORSCAN/2 color graphics workstation "is an idea whose time has come," reported *Digital Review*. It fits two capabilities - VAX<sup>™</sup> access and the ability to run PC applications - into one very small, low-profile enclosure with quiet, diskless operation.

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In other words, "The COLORSCAN/2," according to Frank J. Berfiz, Jr., editor of *PC Magazine*, "is an excellent solution to desktop clutter for any combination of PC, LAN-based and host-based applications."

To find out more, call Datamedia at 1-800-DMC-INFO.

11" retouched screen  
1110 x 15 x 2.5-inch base unit

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*The Positive Response<sup>™</sup>*

CIRCLE 541 ON READER SERVICE CARD  
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## ■ HP CALCULATOR EMULATORS

### HP41E

Of all of the emulators we tested, StraightForward's **HP41E**, at \$115, looks the least like an actual calculator on-screen. In fact, when first loaded, **HP41E** displays a menu screen. From this screen you may select any of a number of canned programs (called buttons) or drop into the calculator's free-entry mode. In this mode **HP41E** displays something resembling a calculator face on the right-hand side of the screen with a display of the stack contents on the left.

**HP41E** duplicates all the functions of the Hewlett-Packard 41C. To emulate the optional libraries of specialized programs that you can buy from HP, StraightForward provides additional buttons. Each button performs a specialized function, and unlike Hewlett-Packard, StraightForward sells these functions separately as well as in collections. The **HP41E** catalog offers hundreds of different buttons, usually at a mere \$5 apiece. Apparently, StraightForward intends for you to rely on these rather than developing your own routines, for **HP41E** provides no debugging or program development capabilities other than those built into the HP41C itself.

**EXTENSIVE HELP** **HP41E** is the only product reviewed here that you cannot install as a RAM-resident pop-up. However,

Keys: INHLL ZOFF 3SHIFT 4CHS 5USER 6EEX 7PRGM 8SST 9ALPHA 10B/S  
Press the [KEY] corresponding to the FUNCTION desired HP41E 1157

4,00000000

X 4,00000000  
Y 3,00000000  
Z 2,00000000  
T 1,00000000  
L -10005,00000

F1 HELP F2 OFF  
F3 SHIFT F4 CHS  
F5 USER F6 EEX  
F7 PRGM F8 SST  
F9 ALPHA F10 B/S

Σ+	1/X	J	LOG	LN	ISG	RTN
Q	W	E	R	T	Y	U
XOY	RDN	SIN	COS	TAN	XO VIEW	
A	S	D	F	G	H	J
SHIFT XEQ	STO	RCL	SST	FS?C	FC?	
Z	X	C	V	B	N	M

The numbers and + - \* / are themselves

You use a combination of function keys and alpha keys to do your calculations on the **HP41E** calculator program.

■ The on-line help of StraightForward's **HP41E** is so extensive that the package has no manual at all and does not even need one.

**HP41E** emulates constant memory by saving values to disk automatically. Whenever you run the program, it loads these values from the disk, so you find the same numbers in the registers as when you last used the calculator.

**HP41E** offers by far the most extensive help screens of any of the packages tested. You can select the level of help you want access to, ranging from full help to almost none. Even in the no-help mode, you execute most of the package's functions from generally self-explanatory menus. In the

full-help mode, the number and length of help screens border on the ridiculous. The on-line help is so extensive that the package has no manual at all and does not even need one.

**HP41E** comes with or without 8087/80287 support, and it supports a Microsoft mouse. StraightForward claims that its product also supports direct PC-to-HP41C transfer via the HP-IL LinkCard and Interface Module, but we were unable to test this feature.

### KSH-1 KSH-2

Unlike the other two packages reviewed here, which are modeled on the high-end HP41C, K Software House's **KSH-1** and **KSH-2** emulate simpler Hewlett-Packard units. **KSH-1** successfully duplicates the functions of the HP11C scientific calculator, and **KSH-2** replicates the HP12C financial calculator, which replaces some of the more advanced scientific functions with those common to business use. Each retails for \$49.95 for the standard version; add \$10 for the 8087 version.



### FACT FILE

#### HP41E

StraightForward  
3901 Via Ora  
Long Beach, CA 90810  
(800) 553-3322  
(800) 237-9680 (in Calif.)

List Price: \$115 for standard version, plus \$2.95 shipping and handling; \$100 for 8087 version.

Requires: 256K RAM, one floppy disk drive, DOS 2.1 or later.

**In Short:** This Hewlett-Packard 41C emulator offers extensive on-line help. StraightForward also provides a wide selection of optional specialized calculation routines for this package. Not copy protected.

CIRCLE 63 ON READER SERVICE CARD



ALL CLONES ARE CREATED EQUAL....BUT CMO MAKES THE DIFFERENCE  
GREAT PRICING • EXPERT CONSULTATION • ONE YEAR WARRANTY



**BASIC SYSTEM CONFIGURATION:**

- NEC V-20 CPU, 12 MHz Speed
- 640K Mother Board Memory
- 8 I/O Expansion Slots
- 360K Floppy Disk Drive
- Floppy Disk Drive Controller
- Clock Calendar with Battery Backup
- 150 Watt Power Supply
- IBM Compatible BIOS
- 4 Half Height Front Storage Slots
- 100-Key AT-XT Switchable Keyboard
- 24 Hour Burn-In

**BASE SYSTEM PRICE:** No CAPC12-01

Monitor Optional

**\$579**

**BASIC SYSTEM CONFIGURATION:**

- 8 MHz 80286 16-Bit Microprocessor
- 512K Motherboard Memory Expandable to 1 MB
- 12 I/O Expansion Slots (6 16-Bit & 2 8-Bit)
- Clock Calendar with Battery Backup
- 1.2 MB Floppy Disk Drive
- Hard Disk/Floppy Controller Card
- 238 Watt Power Supply
- Fully Compatible High Speed BIOS
- 84 Key 5151-Type Style Keyboard
- Microsoft MS-DOS with GW Basic
- 5 Half-Height Front Storage Slots (4 exposed)
- 24 Hour Burn-In
- DOS with GW Basic

**BASE SYSTEM PRICE:** No. CA5170-01

Monitor Optional

**\$999**



**BASIC SYSTEM CONFIGURATION:**

- 10 MHz 80286 16-Bit Microprocessor
- 512K Motherboard Expandable to 1 MB
- 12 I/O Expansion Slots (6 16-Bit & 6 8-Bit)
- Battery Backed-up/Real-Time Clock
- 1.2 MB Floppy Disk Drive
- Dual Hard Disk/Dual Floppy Controller Card
- 238 Watt Power Supply
- Fully Compatible High Speed BIOS
- 5 Half-Height Front Storage Slots (4 exposed)
- 101-Key Enhanced Keyboard
- 24-Hour Burn-in

**BASE SYSTEM PRICE:** No. CA5191-01

Monitor Optional

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FAX 717-327-1217





**IBM  
PS/2 Model 30**  
 • 720KB 3 1/2" Disk Drive  
 • 640K RAM, 8MHz  
 • 20 MB Hard Drive  
 • 101 Enhanced Keyboard  
 No. IBS32

**\$1799**



**IBM  
PS/2 Model 50**  
 • 80286, 10 MHz  
 • 128K ROM, 1 MB RAM  
 • 20 MB Hard Drive  
 • 1.44 MB 3.5" Disk Drive  
 No. IBS50

**\$2859**



**IBM  
PS/2 Model 80**  
 • 80386, 16 MHz Micro Processor  
 • 1 MB RAM, VGA Display  
 • 40 MB Fixed Disk Drive  
 • 1.44 MB 3.5" Disk Drive  
 No. IBS80

**\$5795**



**AST  
Premium Model 140**  
 • 1.2 MB Floppy, 101 Keyboard  
 • FastRAM 1MB  
 • 80286, 10MHz, Zero Wait  
 • AST 3 G Plus Board  
 No. ATP140

**\$2499**



**COMPAQ  
DeskPro 386/20 Model 60**  
 • 80386 Processor, 20 MHz  
 • 1 MB RAM, 1.2 Floppy  
 • 60 MB Hard Drive  
 • Parallel and Serial Ports  
 No. CQ145

**\$5999**



**NEC  
PowerMate II**  
 • 1.2 MB Floppy Drive  
 • 640K RAM, 10 MHz  
 • 40 MB Fixed Disk Drive  
 • MS-DOS 3.2 & GW-Basic  
 No. NH501K

**\$2399**



**TOSHIBA  
T-1000 Lap Top**  
 • Fully IBM compatible  
 • 512K RAM  
 • 720K 3 1/2" Disk Drive  
 • 640 x 200 Pixels  
 No. TB1000

**\$879**



**NEC  
Multispeed EL**  
 • Dual 3 1/2" 720K Floppies  
 • 640K RAM, 512K ROM  
 • BeckM LCD Screen  
 • 9.54 MHz CMOS V-30  
 No. NIMS

**\$1599**



**COMPAQ  
Portable 386 Model 40**  
 • 80386 Processor  
 • 1 Megabyte RAM  
 • 40 MB Fixed Drive  
 • 1.3 MB Diskette Drive  
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**BOCA  
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- 640 x 350 Resolution
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- 256K of Video Memory

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**BOCA  
BocaRam AT**

- 16 Bit, Runs to 16 MHz
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- Expanded, Extended, LIM

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**VIDEO SEVEN  
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- 752 x 410 Display
- EGA, CGA, MGA, HGC
- 256K-DRAM Screen Buf.

No. VSEGA **\$229**



**VIDEO SEVEN  
VEGA V+G+A**

- 800 x 600 Resolution
- 256 Simultaneous Colors
- Supports Both Analog & Digital

No. VSVG **\$329**



**TSENG LABS  
EVA/480**

- 640 x 480 Resolution
- CGA, MDA and Hercules Compat.
- Parallel Port Standard

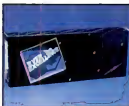
No. TL480 **\$229**



**EVEREX  
Autoswitch Enhancer**

- Autoswitch EGA
- 132 Column Operation
- Parallel Printer Port

No. EV657 **\$149**



**EVEREX  
RAM 3000 Deluxe**

- 0K-3MB Memory
- EMS, Extended, BASE for AT
- Utility Software

No. EV159 **\$9999**



**QUADRAM  
XT386 Board**

- PC Upgrade to 80386 Processor
- 1 MB of Onboard Memory
- Quadmaster Software Included

No. QU3861 **\$799**



**INTEL  
Above Board/286**

- 512K to 3 MB Memory
- Conventional, Expanded & Extended Memory
- AT&XT to 12.5MHz

No. IN4020 **\$349**



**INTEL  
In Board/386/PC**

- Converts PC to 16MHz
- 80386 Microprocessor
- 1MB On Board Memory

No. INIB1200 **\$799**



**INTEL Math Co-Processors**

- No. IN8067 PC **\$129**
- No. IN80267-8AT **\$299**
- No. IN80267-10AT **\$319**
- No. IN80387 **\$539**



**HERCULES  
Graphics Card Plus**

- 720 x 348 Bit Mapped Graphics
- RAM Font Software Included
- Parallel Port

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**ZUCKERBOARD PS/2  
50/60 Multifunction Board**

- 512K to 3 MB Memory
- Parallel and Serial Ports
- EMS and Diagnostic Software

No. HX15 **\$289**



**IDEA 5251  
Terminal Emulation**

- Local Twinax Communication
- IBM 34/36/38 Compatible
- Printer Support, Hot Key

No. IE5251 **\$579**



**DCA  
IRMA Board 2.2**

- Native Mode Coaxial Link
- IBM 3270 Controller Compatible
- SNA/SDLC or BSC

No. IRMA2 **\$799**



**FIFTH GENERATION  
The Logical Connection**

- 4 Serial, 2 Parallel In, 2 Parallel Out
- Daisy-chainable up to 315 devices

No. ICFI02 256K **\$289**  
No. ICFI03 512K **\$369**





**EPSON LX-800**

- 150 cps Draft/30 cps NLQ
- 9 Pin Dot Matrix, 80 Column
- Built-in Tractor Feed
- No. EPLX800

**\$179**



**EPSON EX-800**

- 9 Pin Dot Matrix
- 300 CPS Draft/50 CPS NLQ
- 80 Column, 8K Buffer
- No. EPEX800

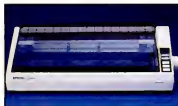
**\$429**



**EPSON EX-1000**

- 9 Pin Dot Matrix
- 300 CPS Draft/50 CPS NLQ
- 132 Column, 8K Buffer
- No. EPEX1000

**\$489**



**EPSON FX-286E**

- 240 cps Draft/40 cps NLQ
- 132 Column, 8K Buffer
- Friction/Tractor Feed
- No. EPLX286E

**\$479**



**EPSON LQ-500**

- 24 Pin Dot Matrix
- 160 CPS Draft/60 CPS NLQ
- 8K Input Buffer
- No. EPLQ500

**\$339**



**EPSON LQ-850**

- 330 cps Draft/60 cps NLQ
- 24 Pin Print Head
- Parallel/Serial with 8K Buffer
- No. EPLQ850

**\$529**



**DICONIX INKJET 150P**

- AC/DC Powered Portable
- Centronics Parallel 8 Bit
- 150 cps Draft/50 cps NLQ
- No. KD150

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**SHARP FO-210 Facsimile**

- Half-Tone Transmission
- Automatic Contrast Adjustment
- Automatic dialing for 87 #'s
- No. SHF0210

**\$1499**



**CANON PC-25 Personal Copier**

- 8 copies per minute
- Wait time 20 seconds
- Copy size up to 356x216 mm
- No. CC25

**\$899**



**OKIDATA ML-193 Plus**

- 200 CPS Draft, 40 CPS NLQ
- 8K Print Buffer
- 9 Wires, 132 Column
- No. OK1931

**\$469**



**OKIDATA ML-293**

- Dual 9 Pin Dot-Matrix
- 240 cps Draft/100 cps NLQ
- 136 column, 8K Buffer
- No. OK293

**\$539**



**OKIDATA ML-393 Plus**

- 450 cps Draft/180 cps NLQ
- 24 Wires Dot Matrix
- Personality Module Concept
- No. OK393

**\$989**





**BROTHER M-1509 Dot Matrix**

- 180 CPS Draft/45 CPS NLQ
  - Auto Paper Loading
  - Friction and Pin Feed
- No. BRM1509

**\$389**



**BROTHER HR-40 Daisywheel**

- 40 CPS, 136 Columns
  - 2 Color Printing
  - Friction and Forms Tractor
- No. BRHR40

**\$499**



**BROTHER HR-60 Daisywheel**

- 60 CPS, 136 Columns
  - Diablo 635 compatible
  - Standard Parallel Interface
- No. BRHR60

**\$739**



**NEC 2200**

- 24-Wire Dot Matrix
  - 170 cps Draft/55 cps NLQ
  - 360x360 Dots per inch
- No. NIP2200

**\$379**



**NEC P760 Pinwriter**

- 24-Wire Print Head
  - 216 cps Draft/65 cps NLQ
  - 136 Column Carriage
- No. NIP760

**\$659**



**CITOH 315XP**

- 300 cps Draft/50 cps NLQ
  - 15" Carriage Width
  - IBM/Epson compatible
- No. TE315XP

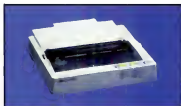
**\$559**



**PANASONIC KX-P1091-II**

- 194 CPS Dot Matrix
  - 9-Pin Print Head
  - IBM Pro Printer Emulation
- No. PA1091

**\$189**



**STAR MICRONICS NX-1000**

- 144 cps Draft/35 cps NLQ
  - 4K Buffer, 80 column, Auto feed
  - Friction and Tractor Feed
- No. SGNX1000

**\$189**



**STAR MICRONICS NX-15**

- 120 CPS Draft, /50 CPS NLQ
  - 5K Buffer, 132 Column
  - Friction & Tractor Feed
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**\$319**



**TOSHIBA P321SL**

- 24 Wire Print Head
  - 216/180/72 cps
  - Character font cartridges
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**\$529**



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- 24 Wire Print Head
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  - 136 column, Parallel/Serial
- No. TB351SX

**\$999**



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- 35 cps Daisywheel
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- Text Display Function

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- Flat non-glare screen

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**AMDEK  
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- 13" In-Line etched screen
- Supports 64 Colors
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**\$429**



**AMDEK  
Monochrome/432**

- PS/2 MCGA & VGA Compatible
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- 31.48 KHz Scan Frequency

No. AM432

**\$179**



**AMDEK  
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- Palette of 256,000 colors
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- 640 x 480 MCGA Compatible

No. AMC732

**\$499**



**PRINCETON  
MAX-12**

- 12" Amber TTL
- 720 x 350 Display
- 16 Shades

No. PNM12

**\$139**



**PRINCETON  
Ultrasync**

- 13" Analog/TTL 28mm Dot Pitch
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- IBM PS/2 & Mac II Compatible

No. PN12U

**\$549**



**ZENITH  
ZMM-149 VGA**

- IBM VGA Monochrome
- 14" High Resolution
- 31.48 KHz Scan Frequency

No. ZVA149 Amber  
No. ZVW149 White

**\$239**



**ZENITH  
ZCM-1490 VGA**

- 14" Analog/TTL .31 Dot Pitch
- 64 Available Colors
- 25 MHz, 640 x 480 Resolution

No. ZEC1490

**\$749**



**THOMPSON  
Model 4120**

- 14" RGB/Comp/Analog
- 560 x 240 Pixel Resolution
- .51 Dot Pitch, 12 MHz

No. TPC4120

**\$239**



**THOMPSON  
Model 4375M**

- 14" Super High Contrast
- 64 Available Colors
- 30 MHz, 800 x 560 Resolution

No. TPC4375M

**\$499**



**NEC 1402  
Multisync II**

- Multisync RGB
- 800 x 560 Display
- 6 Text Switchable

No. NEC1402

**\$599**



**NEC  
Multisync Plus**

- 15" Flattened CRT
- 960 x 720 Resolution
- 3-Way Text Switch

No. NEC1501

**\$999**





**MOUNTAIN  
Drivecard**

- 20 Meg, No. MB20
- 30 Meg, No. MB30
- 50 Meg, No. MB50

**\$489**  
**\$539**  
**\$699**



**MOUNTAIN  
Dual 20 Bernoulli**

- Bernoulli Technology
- Dual 20 MB Cartridges
- Requires PC2 Controller

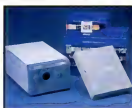
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**PC-T00  
Datasave 4000**

- 40 MB Formatted capacity
- 3 1/2" Pocket Size Cartridges
- Uses existing floppy controller

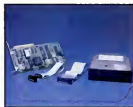
No. MBPC1206 **\$479**



**POLAROID  
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- Computer Image Recorder
- 35mm and 3x4 Film Unit
- 8 Palette Software included

No. PO01P **\$2399**



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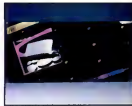
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## ■ HP CALCULATOR EMULATORS



KSH-1 mimics the face of the real HP11C scientific calculator. It even gives you an image of an Enter key on your screen.

KSH calculators do their utmost to present the user with an accurate visual representation of a calculator. The F key is gold, the G key is green, and the frame is gold,

just as on the original. The result is beautiful. Unlike what the other two packages provide, however, no extra displays show anything beyond what the user of a real HP11C or HP12C would see.

**ON-LINE HELP** This direct mimicking of the original extends even to the point of requiring the user to move the cursor about to "push" the buttons on the screen. Fortunately, KSH programs support a Microsoft mouse. With it, I found input to be tolerable; without it, input was just too slow to be useful. An alternative set of input keys allows you to enter values directly from the keyboard without moving the cursor, but the assignments are so obscure that they are very difficult to remember, despite the on-line help. Besides these explanations of key assignments, no other on-line help is provided, since everything else about these calculators is quite straightforward.

You can execute both KSH packages from the DOS prompt, and they will support Microsoft Windows when run this way. They can also be installed as TSR pop-ups, with KSH-2 consuming roughly 65K bytes of RAM and KSH-1 consuming


only about 50K bytes. The hotkey is user selectable, so it will not conflict with those of other RAM-resident programs you may use. As with *ELI-41*, you cannot load either of these programs as a pop-up when you're in the root directory but must first change to the directory that contains the program and its support files—a minor nuisance when loading the program from an AUTOEXEC.BAT file.

When run as TSRs, KSH-1 and KSH-2 offer some attractive features. Not only can they export single values by assigning the X register to a hotkey, they are unique in being able to import large blocks of data at one time. The user simply marks off a block of the screen containing as many numbers as desired. Subsequently, each time the user hits the Import key, the next value from the block is entered sequentially into the calculator. This is such a simple and elegant improvement over the standard single-value import, I am surprised more calculators do not offer it. Both calculators also come with a separate RAM-resident notepad utility.

## PC-12C


The very first sentence of *PC-12C*'s manual explains its purpose: "Your *PC-12C* . . . is a complete emulation of the Hewlett-Packard 12C financial calculator."

Unlike the HP12C, however, Popular Programs' *PC-12C* is not programmable. In addition, *PC-12C* makes no attempt to emulate the constant memory feature of the calculator by saving values to disk, as



**FACT FILE**

**KSH-1**  
**KSH-2**  
K Software House  
Route 2, Box 83B1  
Unionville, TN 37180  
(615) 294-5090  
List Price: KSH-1, standard version, \$49.95 plus \$3.00 shipping and handling; \$49.95 for 8087 version; KSH-2, standard version, \$69.95 plus \$3.00 shipping and handling (\$79.95 for 8087 version).  
Requires: 128K RAM, one disk drive, DOS 2.0 or later.  
In Short: The KSH-1 emulates the HP11C, and the KSH-2 emulates the HP12C. Their awkward method for manual input limits their usefulness, but when run as TSRs, they offer a handy and unique capability to import blocks of data from the screen. Not copy protected.  
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**FACT FILE**

**PC-12C**  
Popular Programs Inc.  
135 Lake St., #180  
Kirkland, WA 98033  
(800) 447-6786  
(206) 822-7065  
List Price: \$69.95  
Requires: 66K RAM, one floppy disk drive, DOS 2.1 or later.  
In Short: An HP12C emulation program that conveniently uses the keyboard for manual input. However, it is not programmable. Not copy protected.  
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## REVERSE POLISH NOTATION

The algebraic notation in common use today has been formulated by scientists and engineers over the centuries for solving mathematical problems on paper. For this medium it is ideal, but on calculators it can become awkward.

You're fine if you want to multiply the numbers 3 and 5 on a normal calculator. You simply enter "3 X 5 =" to get the answer. Multiplying a number times a sum—say 3 times the sum of 4 and 1—is also a fairly simple task. You just enter "3 X (4 + 1) =" and the parentheses force the addition to be performed before the multiplication. Yet when calculations become more complex and involve sets of parentheses within other sets, the memories of both operator and calculator begin to feel the strain.

When Hewlett-Packard introduced its first scientific calculators, their memories were small and their processors very slow. The company needed a way to reduce the demands made on the calculator (if not on the operator) and found it in Reverse Polish Notation (RPN). HP now uses RPN on nearly all the calculators it makes, while all other calculator manufacturers have clung to the normal algebraic symbology. (Non-RPN calculators are also known as "TI style" calculators, as opposed to "HP style.")

RPN changes the order of the numbers and the operators. To multiply the two numbers in our first example above, you would punch in "3 <Enter> 5 X." The special Enter key separates one number from another.

To perform its calculations, an HP calculator maintains a four-member

stack, using the names X, Y, Z, and T for the four positions. Numbers are entered into the X position, which is also the position the calculator displays. The Enter key pushes the value of the X into the Y position, the Y into the Z position, and the Z into the T position. Addition and multiplication are performed on the values in the upper two positions of the stack, with the result being placed in the X position, where it is also displayed. The values in the remaining positions are moved up accordingly.

**STACK STRUCTURE** For each step of the example above, the stack would look as it does in Figure A.

The advantage to this system (other than eliminating the need for an Equal Sign key) becomes apparent in multiplying a number times a sum. "3 X (4 + 1) =" would be entered as "3 <Enter> 4 <Enter> 1 + X." In Figure B we can see immediately why this works. This

makes things easier for the calculator, but the user is still compelled to remember what values are in the various stack positions. Although this may not seem any easier than remembering the number and location of parentheses, those devoted to the HP calculator maintain that it is. These aficionados—mostly from the engineering and scientific community—look upon TI-style calculators with the same disdain a PC disciple reserves for a Macintosh. It seems, though, that even Hewlett-Packard now recognizes that RPN isn't for everyone, for its newest financial calculator, the HP18C, supports TI-style entry exclusively.

Style preference should not be the determining factor in buying a calculator or a calculation program. The presence or absence of critical functions, programmability, the number of registers, and the quality of construction are just as important as the order of entering numbers.—Stephen Randy Davis

3	<Enter>	5	X
X: 3	X: 3	X: 5	X: 15
Y: ?	Y: 3	Y: 3	Y: ?
Z: ?	Z: ?	Z: ?	Z: ?
T: ?	T: ?	T: ?	T: ?

Figure A: The stack setup for a "3 X 5" calculation.

3	<Enter>	4	<Enter>	1	+	X
X: 3	X: 3	X: 4	X: 4	X: 1	X: 5	X: 15
Y: ?	Y: 3	Y: 3	Y: 4	Y: 4	Y: 3	Y: ?
Z: ?	Z: ?	Z: ?	Z: 3	Z: 3	Z: ?	Z: ?
T: ?	T: ?	T: ?	T: ?	T: ?	T: ?	T: ?

Figure B: The advantage RPN is clear in this "3 X (4 + 1)" stack.

did some of the other programs reviewed.

Like the other HP12C emulator, *KSH-2*, *PC-12C* does its best to mimic the appearance of the real thing on the PC's screen. It is not quite as attractive in appearance as *KSH-2*, but *PC-12C*'s display is nonetheless an accurate and functional representation. Like the *KSH-2*, the *PC-12C* suffers from the absence of the extra

information on such things as flags and registers that the displays of the HP41C emulation programs provide.

*PC-12C* maps the keys of the HP12C onto the PC keyboard's white keys. Thus, the upper-left-hand key on the HP12C, the *n* key, is rendered as a 1 on the PC's keyboard; the next key, the *i*, maps onto the 2, and so on. This is all very nice, except that

it leads to some odd conventions such as using the U key on the PC's keyboard for the digit 4, 1 for the 5, and so forth. This is not really a problem, however, since numbers also may be entered through the numeric keypad and, in any case, the keys are displayed on the screen. The gold functions are accessed either by using the Left Shift key or by first entering F. Similarly,



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Popular Programs™ PC-12C produces a picture of the HP12C calculator on the screen of your PC.

the green functions use the Right Shift or the G key. This system is more logical and easier to use than KSH-2's approach of "pressing" the keys shown on the screen.

PC-12C may be executed as a pop-up program or as a normal applications program. When installed as a pop-up, PC-12C consumes 58K bytes of RAM. The user can select the hotkey that invokes the program. Should there be a conflict, you can enter the hotkey twice; this usually brings up the PC-12C as you are running the other application. On-line help is available by hitting the F1 key. There is also a function to display a "tape" that shows the last few operations, prints them, or saves them to disk. The tape can also be stamped with messages of up to 23 characters in length, a useful feature. PC-12C will feed single values to other applications but will not read values off the application screen.

When installed as an application itself, PC-12C requires 128K bytes and DOS 2.0 or later. It does not require a hard disk and is not copy protected. PC-12C responds instantaneously with or without a floating-point processor.

While PC-12C performs acceptably, its lack of programmability keeps it from fully emulating the HP12C. But at the

## EDITOR'S CHOICE

### • ELI-41 Professional Scientific Calculator Software

*Despite the accurate HP emulation provided by KSH-1 and KSH-2 and the extensive on-line help offered by HP41E, the Editor's Choice goes to ELI-41 Professional Scientific Calculator Software. Its powerful program-editing feature and informative multiple displays set ELI-41 apart from its competitors. One glance at its screen gives the user detailed insight into the inner workings of the calculator. In fact, we found ELI-41 easier to use than the Hewlett-Packard 41C itself.*

same time, in its efforts to mimic a calculator, PC-12C doesn't really utilize the advantages of the PC.

Stephen Randy Davis is a frequent contributor to PC Magazine.





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# SPREADSHEETS FOR MODEST PROPOSALS

**T**he recent introduction and announcements of *Microsoft Excel*, Borland's *Quattro*, Lotus 1-2-3 (Release 3), and PCSG's *Lucid 3D* has shifted all eyes to these spreadsheet heavy-hitters. As a result, those in the know have developed a serious case of high-end tunnel vision. But not everyone needs or wants a powerhouse of a program. What about a spreadsheet for the rest of us?

Time, money, and a realistic vision of one's own workplace make lower-end spreadsheets an alternative for those with more-modest needs. In this issue we look at a diverse group of products that offer alternatives to expensive, full-featured spreadsheets. Some, such as Expressware's *ExpressCalc*, Stilware Software's *FreeCalc*, FormalSoft's *InstaCalc* and *QubeCalc*, and Paperback Software's *Number Works*, are abbreviated *stand-alone* spreadsheets—spreadsheets that

don't offer the full functionality of the big guys. Others, like Tandy's *DeskMate II*, Alpha Software's *Electric Desk*, Open Systems' *Harmony Spreadsheet*, *Microsoft Works*, ButtonWare's *PC-Calc*, Peachtree Software's *PeachText 5000*, Software Publishing's *PFS:First Choice*, Scandinavian PC Systems' *Spreadsheet for the IBM PC, XT, and AT*, and Indian Ridge Enterprises' *THE Spreadsheet*, offer an *integrated* software solution—that is, making the spreadsheet component a part of a larger system. Still others, such as Cotton Software's *BoxCalc 1000*, SimpleSoft Products' *It Figures*, and Lotus 1-2-3 *Small Business Kit* (all reviewed in the sidebar "Alternative Alternative Spreadsheets") are quasi-spreadsheet *alternatives* for those with less-traditional bents. You'll find the reviews of these products grouped into their respective categories and listed alphabetically by product name within each group.

*Not everyone needs the power (or wants to pay the price) of a 1-2-3-class spreadsheet. The 14 packages reviewed here all cost less than \$200 and provide tools in scale with simpler applications.*



## ■ LOW-END SPREADSHEETS

**IS SMALL BEAUTIFUL?** As a writer, using 1-2-3 to take care of my monthly expense reports and budgets is like using a chain saw to cut my spaghetti. Smaller spreadsheets offer tools in scale with such relatively simple applications.

"Fancy spreadsheets are overkill for a lot of people," comments Alex Kask, president of the MicroManagers Association (MMA). "Most people are dealing with small data sets and fairly simple problems. You could use the first version of *VisiCalc* to handle probably 90 percent of all the spreadsheet applications that people use."

Low-end spreadsheet packages tend to be smaller, more manageable, and less demanding in a number of different areas: There's less demand on the user to own snazzy hardware like additional memory add-in boards or a numeric coprocessor because these packages have only minimal hardware requirements. There's less demand on the time users devote to learning because there's a lot less package to become proficient in. There's less demand on the user's pocketbook because none of these packages, even the fully integrated systems, cost more than \$199, and one costs as little as \$15.

In turn, most of these packages typically don't offer the full deck of spreadsheet features. Generally speaking, these spreadsheets are pretty good about handling simple, linear formulas, but many can't cope with more-complex matrix math. Most of these spreadsheets don't come anywhere near the 256-column by 8,192-row workspace capacity of 1-2-3; some offer workspaces as small as 99 by 99—though one of them does give you a 9,999 by 9,999 area. Recalculation, as well as storing and retrieving files, tends to be considerably slower than with 1-2-3. While one package, *PC-Calc*, performed recalcs as quickly as 1-2-3, the rest of the packages performed from one and a half to nearly eight times slower than 1-2-3 on the PC Labs speed performance tests. Often these packages are limited in the number of cell and global formats available. Most don't support expanded memory, protected passwords, or locked spreadsheets. In general most of them eliminate higher-end extras such as linked spreadsheets, intelligent recalcs, a graphics feature, built-in

macros, coprocessor and extended memory support, and a sparse memory-matrix design.

The worst offenders lack commonly used features such as named ranges, absolute and relative cell references, a drop down to DOS, and the ability to look at a directory of files. The formula entry functions can be a bit wacky and eccentric, and the formula-editing functions on some of these programs could make a nonspread-

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■ Some of these simple low-end spreadsheet programs are real treasures, others are ugly but functional ducklings, and still others are just plain cheap.

---

sheet user out of anyone. And a few lack coherent documentation.

We looked at a flock of simple spreadsheets, all vying for this more modest lower-end market. Needless to say, some are real treasures, others are ugly but functional ducklings, and others are just cheap. Those shopping for alternatives to the big-name spreadsheet projects can choose from these major categories:

■ **Simple Standalones: A Dying Breed** These products are inexpensive, watered-down versions of standard spreadsheets. In theory, these spreadsheets are one way of getting your feet wet without committing tremendous resources. But, with prices ranging from \$15 to \$169 a shot—and with unexceptional performance—you may find it's better to take the plunge with one of the full-featured 1-2-3 alternatives (several cost as little as \$99).

The products claim to be easy to learn and easy to use, but this is debatable. Don't ever make the mistake of equating low cost with ease of use. Typically these products are developed and marketed on

low budgets; often it's apparent that the user interface was not the major concern. The documentation tends to be sparse. You'll outgrow these products quickly. Granted, standalone spreadsheet developers deserve a certain amount of credit for forging novel user interfaces, but let's face it, at least with 1-2-3 copycat products you can be sure that the user interface was swiped from folks who knew what they were doing!

Shareware spreadsheet products have proved to be some of the most pleasant spreadsheet alternatives available. *QubeCalc* and *InstaCalc* are gems, *PC-Calc* has become the shareware industry standard, and *ExpressCalc* will delight *SuperCalc* users for a fraction of the cost. These programs offer a great deal of power for a very affordable price.

The "try before you buy" credo was originally appealing to low-budget home- and small-business users, but according to representatives at these companies, these "alternative distribution" programs are turning up on the hard disks of some major corporations (whether they get used is another question).

"We provide a low-cost alternative to people who need a spreadsheet but don't have the money to buy 1-2-3," says Jim Button, a pioneer and long-time survivor of the shareware business. "All of our software is low priced and has as much of the function of the big boys as possible." Button says he's not concerned about hardware limitations. "We've found that people do want features," he says, "and our users have the required hardware."

■ **Integrated Packages: A General-Strength Solution** Integrated packages proved to be a more reasonable alternative. This genre is not new, but fresh ideas and fresh blood are emerging. Though priced at only \$195, *Microsoft Works* offers most of the spreadsheet capabilities that all but die-hard power users will ever need, including macros, a variety of graph types, and most of the standard mathematical functions. The latest version of *PFS:First Choice* adds graphics and 1-2-3 compatibility to an already well-received program. Alpha Software, maker of *Electric Desk*, is announcing its next generation of integrated software even as we review the current one.



## ■ LOW-END SPREADSHEETS

Manufacturers are defining integrated packages as a complete solution for the small-business user rather than for the user who needs sophisticated functions built into each component of the program. According to Microsoft, which recently entered this ball game with *Microsoft Works*, the software is intended for the "breadth" user who needs to access a number of applications routinely and doesn't need one in-depth application. As these users move from application to application, they desire a consistent user interface. Packages like *Microsoft Works* also attract the first-time user—the user who may have purchased a low-cost PC system and now wants the software equivalent. When you buy a complete system for under \$1,000, it's doubtful that you'll run out to buy a spreadsheet for \$495.

Other users are introduced to the concept of integrated packages when they come bundled with a low-cost PC. Both *Electric Desk* and *DeskMate II* are sold with hardware. Smart integrated software developers are also recognizing the need for upward compatibility. *PFS:First Choice*, Version 2, includes a 1-2-3 and *PFS:Plan* import/export facility. As the big-league software packages grow bigger and bigger, require more and more hardware, and sport heftier price tags, we can expect to find an increasing number of users who see "five for the price of one" as a tantalizing proposition.

A variation of the integrated package is the modular package. These packages, including *THE Spreadsheet* and *Harmony Spreadsheet*, are sold as separate entities, but they work, with varying degrees of success, with other application modules available from these companies. The benefit of the modular approach is that you get to pick and choose modules in order to best tailor a personal productivity solution. The caveat is that the degree of data integration and functional similarity between modules is not as high as in truly integrated packages.

And while the initial encounter with an integrated package may feel like a marriage, the honeymoon may be short-lived if your needs grow or change. Study the features carefully, if you try to do more than the system can do, you'll only feel aggravated.

**NICHES AND NOVELTIES** The original electronic spreadsheet was a novel invention, and two others we've seen during this review are novelties in their own right. Refreshing oddities such as *It Figures*, a hybrid calculator/spreadsheet, and *BoxCalc 1000*, which uses boxes instead of cells and includes a flexible word processor for easy creation of proposals that include both text and figures, remind us that there is room for innovation and that many innovations are made outside of the large R&D offices. We can surely expect to see more variations on these spreadsheet themes in the future.

So far, the big guys don't have much to be afraid of. The "not very significant" other segment of the spreadsheet market holds only a puny 4 percent (50,000 copies), according to DataQuest. "Everybody hears about what a spreadsheet can do, and then they go out and buy *Lotus*," says Kask (a *SuperCalc4* user himself). "There's a lack of consciousness about other available alternatives."

On the other hand, low-cost integrated packages with spreadsheet components and shareware spreadsheets do seem to be gaining followers. Standalone mini-spreadsheets appear to be sinking into oblivion—partly because they are inferior products, but partly, because of the hubbub that the low-cost 1-2-3 clones have

generated. Why buy a \$70 non-*Lotus* spreadsheet when you could have the quasi-real thing for a few dollars more?

**WHEN BIG IS BEAUTIFUL** There's a certain comfort in using the same software as the rest of the world. The larger spreadsheets have the numbers (user numbers, that is) on their side. They all import and export from outside sources. They all have copious literature and tutorials included in the packages and available from third-party sources. When was the last time you saw a book about *PeachText 5000* on the shelves at your local bookstore?

The big guys have third-party add-in software for everything from templates, to note-takers, to natural-language interfaces. Most are well aware that many users need only a subset of their program's features, and they accommodate. *SuperCalc's* "10 Minutes to SuperCalc" may be the only 10 minutes some users ever need to spend with the reference material. *Lotus Development Corp.* is taking a different tack by answering what it considers to be the needs of the small-business users with its *Lotus 1-2-3 Small Business Kit*. The comfort factor in doing what the Joneses do should not be underestimated in choosing a spreadsheet (especially when you need to read Mr. Jones's data into your spreadsheet).

Large packages are often far easier to learn and to use than their minicounterparts. They support enough hardware to make use of more-graphical environments, and they require enough memory to include better help, tutorials, and prompts. They make difficult features easy to master by including goodies such as a macro learn mode, a cleaner pathway to and through DOS, better customer support, constant upgrades, and support for external devices.

Reflecting on the macho versus mini-spreadsheet quandary reminds me of the guy who drives his brand-new BMW into New York City. With a 55-mph speed limit and traffic at every corner, it's unlikely he'll use his vehicle to its potential. So, if you can't push a BMW to its limit, why not go out and buy a Yugo? I don't know for sure why not, but I do see a lot of BMWs mired in traffic as I look out my window.—Robin Raskin

## OUR REVIEWERS

**Merv Adrian** is a frequent contributor to *PC Magazine*.

**Mike Falkner** is a PC consultant based in Sacramento, California.

**Donald C. Peckham** is a resident engineer at Hyster Company's Berea, Kentucky, industrial lift-truck manufacturing facility.

**Martin L. Ramsay** is the general manager of Ceath Company, a firm that specializes in information management consultation for small businesses in the central Kentucky area.

**Robin Raskin** is a New York-based free-lance writer and frequent contributor to *PC Magazine*.

**William H. Stewart** is a principal with the accounting firm of Price & Paige in Clovis, California.



## ■ LOW-END SPREADSHEETS



### Low-End Spreadsheets: Summary of Features

(Products listed in ascending price order)

#### INTEGRATED

	PC-Calc	Spreadsheet for the IBM PC, XT, and AT	THE Spreadsheet	DeskMate II	Electric Desk	PFS: First Choice	Microsoft Works
	Shareware: \$39.95 registration fee	\$49.95	\$49.95	\$99.95	\$129.00; \$179.00 (w/spelling checker and thesaurus)	\$149.00	\$395.00
<b>Size</b>							
Max. no. of columns and rows in work area	64 x 256	26 x 100	255 x 64	99 x 99	2,048 x 255	1,024 x 768	256 x 4,096
Range of column widths	0-75	0-255	3-77	3-77	1-73	Unlimited	0-79
Database can be larger than spreadsheet	○	○	●	○	●	○	○
<b>Enhancing performance</b>							
Has sparse memory matrix to conserve RAM	○	○	○	●	●	●	●
Uses expanded memory	○	○	○	○	○	○	○
Uses math coprocessor	○	○	○	○	○	●	○
<b>Functions and formulas</b>							
No. of math functions	14	18	14	10	6	17	20
No. of logical functions	5	4	None	None	3	5	15
No. of financial functions	6	1	1	None	5	9	9
No. of date and time functions	6	2	None	None	None	None	6
No. of statistical functions	6	7	3	6	5	5	7
No. of string functions	None	None	1	None	3	1	None
No. of logical and arithmetic operators	10	11	5	6	7	5	16
<b>Macro capabilities</b>							
Macros reside in worksheet	●	●	○	○	●	○	○
Macros reside in library	○	○	○	○	○	○	●
<b>Worksheet commands and features</b>							
Has ability to do named range	○	○	○	○	○	○	●
Cursor keys enter cell data	●	○	○	●	●	●	●
Hides columns	●	●	○	○	○	○	●
Hides rows	●	○	○	○	○	○	○
Hides individual cell components	●	●	○	○	○	○	○
Has cell protection	●	●	●	○	●	○	●
No. of split screens	None	None	2	None	2	None	2
Split screens scroll independently	○	○	●	○	●	○	●
Split screens format independently	○	○	●	○	●	○	○
Can back-step through previous commands	●	●	○	○	○	○	●
Warns against file overwrite	○	●	●	○*	●	●	○
Does recalc in logical order	○	○	○	○	●	●	○
Formats cells to display numbers as words	○	○	○	○	○	○	○
Has context-sensitive help	○	○	●	○	●	●	●
<b>Data exchange</b>							
Merges contents of spreadsheets	●	●	●	●	●	○	○
Imports .WKS files	○	○	○	○	○	○	○
Exports .WKS files	○	○	○	○	○	●	●
Imports .WK1 files	○	○	○	○	○	○	○
Exports .WK1 files	○	○	○	○	○	○	○
Imports ASCII files	○	●	○	○	●	○	○
Exports ASCII files	●	●	○	None	○	○	○
Imports .DIF files	●	●	○	○	○	○	○
Exports .DIF files	○	○	○	○	○	○	○
<b>Printing</b>							
Prints spreadsheets larger than 80 columns on a single page	●	●	●	●	●	●	○
Prints defined areas	●	○	○	●	●	●	●
<b>Graphics</b>							
No. of graph types	1	None	1	None	None	12†	6



\* Indicates Editor's Choice    ● = Yes    ○ = No    \* Provides built-in protection against overwriting a file.    † You can create more graph types by combining the various elements of



# STANDALONE

	Harmony Spreadsheet	PeachText 5000	FreeCalc	ExpressCalc	PC InstaCalc	PC GubeCalc	Number Works	1-2-3, Release 2.01
	\$100.00 (including required System Manager)	\$199.00	Shareware: \$10.00 registration fee, without documentation; \$47.50 registration fee, with documentation	Shareware: \$15.00 registration fee, without printed manual; \$49.00 registration fee, with printed manual	Shareware: \$49.95 registration fee	Shareware: \$69.95 registration fee	\$36.95	\$495.00
<b>Size</b>								
Max. no. of columns and rows in work area	52 x 650	63 x 254	50 x 250	256 x 64*	256 x 256	64 x 64 x 64	9,999 x 9,999	256 x 8,192
Range of column widths	1-30	0-127	0-70	0-75	0-75	1-75	5-75	1-240
Database can be larger than spreadsheet	○	○	○	○	○	○	●	○
<b>Enhancing performance</b>								
Has sparse memory matrix to conserve RAM	○	○	○	○	●	●	●	●
Uses expanded memory	○	○	○	○	○	○	○	●
Uses math coprocessor	○	○	●	○	○	○	○	●
<b>Functions and formulas</b>								
No. of math functions	15	13	None	17	12	12	13	17
No. of logical functions	1	5	None	1	5	5	1	7
No. of financial functions	4	1	None	5	4	4	1	11
No. of date and time functions	2	None	None	1	9	9	None	11
No. of statistical functions	4	4	None	6	7	7	5	14
No. of string functions	4	None	None	None	10	10	None	11
No. of logical and arithmetic operators	11	11	4	10	14	14	15	15
<b>Macro capabilities</b>								
Macros reside in worksheet	○	○	○	○	●	●	○	●
Macros reside in library	○	○	●	●	○	○	○	○
<b>Worksheet commands and features</b>								
Has ability to do named range	○	○	○	○	●	●	○	●
Cursor keys enter cell data	●	○	○	●	●	●	○	●
Hides columns	○	●	●	○	○	○	○	●
Hides rows	○	○	○	○	○	○	○	○
Hides individual cell components	○	○	○	○	○	○	○	○
Has cell protection	●	●	○	○	○	○	○	○
No. of split screens	2	2	None	None	None	None	8	2
Split screens scroll independently	●	●	○	○	○	○	○	○
Split screens format independently	○	○	○	○	○	○	○	○
Can back-step through previous commands	○	○	○	○	○	○	○	○
Warns against file overwrite	●	○	○	○	○	○	○*	○
Does recalc in logical order	○	○	○	○	○	○	○	○
Formats cells to display numbers as words	○	○	○	○	○	○	○	○
Has context-sensitive help	○	○	○	○	○	○	○	○
<b>Data exchange</b>								
Merges contents of spreadsheets	○	○	○	○	○	○	○	○
Imports .WKS files	○	○	○	○	○	○	○	○
Exports .WKS files	○	○	○	○	○	○	○	○
Imports .WK1 files	○	○	○	○	○	○	○	○
Exports .WK1 files	○	○	○	○	○	○	○	○
Imports ASCII files	○	○	○	○	○	○	○	○
Exports ASCII files	○	○	○	○	○	○	○	○
Imports .DIF files	○	○	○	○	○	○	○	○
Exports .DIF files	○	○	○	○	○	○	○	○
<b>Printing</b>								
Prints spreadsheets larger than 80 columns on a single page	○	○	○	○	○	○	○	○
Prints defined areas	○	○	○	○	○	○	○	○
<b>Graphics</b>								
No. of graph types	1	None	None	1	2	2	None	5

FFS: First Choice's ten basic graph types.



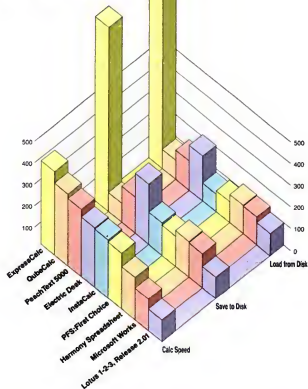


## Performance Tests: Low-End Spreadsheets

When we compared Lotus 1-2-3 with other high-end spreadsheets in "Challenging 1-2-3 on Price and Power" in *PC Magazine*, October 27, 1987, we found that 1-2-3's calc speed was faster than all but 2 of the 12 packages that were able to run our performance tests. It's therefore more than a pleasant surprise to find that PC-Calc matches 1-2-3 on pure calculation speed (though the package does take twice as long to save the file to and load it from disk). All of the other packages performed calculations much more slowly than 1-2-3, with times ranging from 1.5 to nearly 8 times as slow. But many of the packages were a match for the venerable standard in saving the test spreadsheet to and loading it from disk.

Because PFS:First Choice, InsteCalc, QubeCalc, and Microsoft Works were the only packages that could import the Lotus 1-2-3 files in which our test data was created, we entered many of the data and formulas by hand. Spreadsheet for the IBM PC, XT, and AT and PC-Calc were able to run the smaller, but not the full-sized performance tests. A number of the packages were unable to do the performance tests at all. DeskMate II and THE Spreadsheet were unable to do the matrix mathematics that were a part of the formulas included in the test spreadsheet. Number Works could not be tested because it allows formulas of no longer than 40 characters. FreeCalc was not included because it is unable to calculate square roots, another of the elements of the tested spreadsheet.

**Relative Times**  
(Lotus 1-2-3, Release 2.01 = 100)



### 2,080-Cell Worksheet Tests

#### Performance Times (Times given in seconds)

	Calc Speed	Save to Disk	Load from Disk	Worksheet Memory (K)	Memory Used (%)	Disk Space (K)
ExpressCalc	266.8	34.7	85.4	412.0	30	88.6
QubeCalc	229.7	3.6	5.7	454.3	24	86.4
PeachText 5000	214.7	6.9	6.6	511.0	14	71.3
Electric Desk	189.8	11.3	13.2	400.0	27	121.6
InsteCalc	186.2	6.0	5.3	120.6	71	70.1
PFS:First Choice	180.3	5.6	6.2	N/A	84	149.0
Harmony Spreadsheet	137.4	8.6	8.3	90.0	82	86.8
Microsoft Works	102.3	6.5	8.0	N/A	21	62.0
Lotus 1-2-3, Release 2.01	69.5	4.1	6.3	413.8	20	79.9

N/A—Not applicable; program did not report how much memory was available



**Relative Times**  
(Lotus 1-2-3, Release 2.01 = 100)

Since not all of the spreadsheets reviewed in this issue were able to handle the performance tests used to evaluate the full-sized spreadsheets in the October 27, 1987 issue, we ran two tests. Since you might want to compare these spreadsheets with the ones reviewed in the previous issue, we ran the full-size test for which we filled the 2,080 cells between A1 and Z80 with labels and with formulas that do four-function math and square roots.

In the second, medium-size test, we cut down the spreadsheet size and filled the 1,024 cells between A1 and M80 with labels and with formulas that do four-function math and square roots. Both of these tests were conducted on an 8-MHz AT with 640K RAM and a 30MB hard-disk drive.

The **Calc Speed** test measures the length of time it takes the program to recalculate the test spreadsheet.

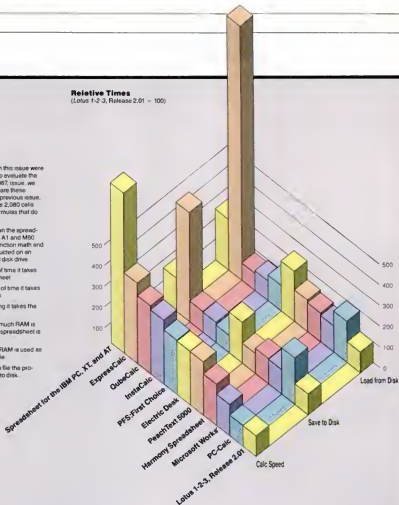
The **Save to Disk** test measures the length of time it takes the program to write the spreadsheet to disk.

The **Load from Disk** test measures how long it takes the program to read the spreadsheet from disk.

The **Worksheet Memory** test reports how much RAM is available for spreadsheet models when the spreadsheet is empty.

The **Memory Used** test reports how much RAM is used as a percentage of worksheet memory available.

The **Disk Space** test measures how large a file the program writes when it saves the spreadsheet to disk.



## 1,024-Cell Worksheet Tests

### Performance Times

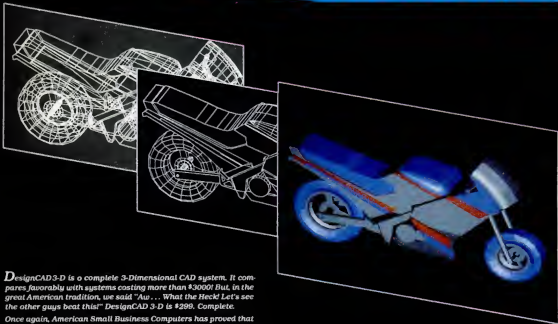
(Times given in seconds)

	Calc Speed	Save to Disk	Load from Disk	Worksheet Memory (K)	Memory Used (%)	Disk Space (K)
Spreadsheet for the IBM PC, XT, and AT	268.7	5.7	8.5	N/A	83	35.0
ExpressCalc	135.3	18.4	42.6	412.0	15	43.8
QubeCalc	114.0	3.5	2.9	454.3	12	43.9
InstaCalc	107.3	3.4	3.4	120.6	36	35.4
PFS:First Choice	91.3	3.0	4.4	N/A	35	75.2
Electric Desk	89.8	6.9	8.5	400.0	16	76.0
PeachText 5000	89.5	3.4	5.3	511.0	7	36.1
Harmony Spreadsheet	69.5	4.2	4.9	90.0	41	44.0
Microsoft Works	52.7	4.1	4.4	N/A	10	42.0
PC-Calc	35.2	7.8	6.9	328.0	41	77.0
Lotus 1-2-3, Release 2.01	34.8	3.5	3.5	413.8	10	40.7



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DesignCAD 3-D does not require expensive graphics adapters and monitors - even shading can be done on ordinary displays such as the Enhanced Graphics Adapter (EGA), Color Graphics Adapter, or Hercules monochrome adapter.

However, the best reason to buy DesignCAD 3-D is not the low price. It's not the outstanding performance. It's not the extensive hardware compatibility. The best reason to buy DesignCAD 3-D is for its amazing ease of use!

DesignCAD 3-D provides powerful commands you can use to produce professional 3-Dimensional drawings in less time than you thought possible! DesignCAD 3-D commands can be selected from the menu or entered as fast, single keystroke commands. We have found DesignCAD 3-D to be easier to learn and easier to use than any 3-Dimensional CAD system for the IBM PC, at any price!

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## Standalone Products

### ExpressCalc

Expressware Corp.'s *ExpressCalc* is a shareware program that is patterned after *SuperCalc*, Version 1.0. It contains many high-level features, including sophisticated financial and statistical functions. The program has over 16,000 cells (256 columns by 64 rows default), making it attractive to users with moderate spreadsheet needs. The registration fee for the package is \$49.

*ExpressCalc* uses the standard row-and-column format, where A1 stands for the intersection of column A and row 1. The program uses the top 22 lines for worksheet information, while lines 23 and 24 display the command menus. You enter your formulas, numbers, and text at the bottom of the screen.

Like *SuperCalc*, the package examines the data you enter to determine whether it is a formula, such as B6+B7 or G27/E29; text; or a function such as SUM(A1:A15). There is no need to precede formulas with annoying prefixes like the plus or minus signs to indicate the operations to be performed, as you must do with *1-2-3*. *ExpressCalc* does not require an at-sign "@" in front of functions, although you can use one if you wish. You move through the spreadsheet using the cursor,

Home, and End keys. You can also use the cursor keys to enter information and move on in the same step, as in *1-2-3*.

*ExpressCalc* commands are similar to those of *SuperCalc*. You activate the *ExpressCalc* commands by pressing the Slash key and the first letter of the command. There are no speed keys or moving-bar alternatives.

Besides such standard commands as print, format, and blank, *ExpressCalc* lets you sort data. You can also import information into your worksheet from other *ExpressCalc* spreadsheets, Expressware's *File Express* database package, and files in .DIF, ASCII, or PC-File format.

Many of the functions you'd find in a larger, more expensive package are included in *ExpressCalc*. Besides the basics, such as IF, LOOKUP, minimum, and maximum, it offers many financial functions, including net present value, payment, and average. You'll also find sophisticated statistical functions such as sin, cos, tan, standard deviation, and SQR. Small-business users and engineers dealing with these questions on a daily basis will especially appreciate having access to these functions.

One of the program's minor annoyances is that you can't use cursor keys to build ranges or copy your formulas automatically. You have to type in the command sequence as well as the names of the cells that will be affected. It would also be nice to be able to import and export *1-2-3* files into *ExpressCalc*. More annoying is the program's speed; its calc speed is nearly four times slower than that of *1-2-3*. *ExpressCalc* has no macro capabilities and only one graph type—a bar graph.

The documentation consists of a brief user guide, a tutorial, and a comprehensive reference manual. In addition, ExpressWare furnishes information on how to customize the program's defaults. The manual also explains how to read and write *ExpressCalc* files with user-designed applications.

Installing *ExpressCalc* is as simple as copying it onto your hard disk. Since the *ExpressCalc* disks are not self-booting, users with a two-floppy-disk system should transfer the program to a bootable DOS disk so that it can load automatically at start-up. The package comes with configu-

ration files for 40- and 80-column modes as well as for color and monochrome screens. Once you've loaded *ExpressCalc*, you can change screen colors in the foreground, background, and menu bar area. The program comes preconfigured for most of the popular printers, including the Epson, IBM Proprinter, Okidata, Toshiba, and MPI models, but you can easily override those settings with a setup string if needed.

Admirers of *SuperCalc* who want the capabilities of that package without paying its hefty price probably won't find *ExpressCalc*'s \$49 registration fee too costly. But others may find that figure a bit high, especially considering that the mail-order price of some good *1-2-3* clones is around \$60 or \$70. But you can't really go wrong investing in *ExpressCalc*: it gives the user access to some relatively sophisticated functions, and its 264-row by 64-column workspace is more than adequate for most moderate spreadsheet needs.


—Mike Falkner

### FreeCalc


As its name implies, *FreeCalc* is a shareware package. If you like the package, the manual suggests you send \$47.50 to its author, Stilwell Software Products, to become a registered owner. This entitles you to support, a printed copy of the manual, and an additional program called *FreeCalc Auditor*, which pinpoints spreadsheet errors, forward references, and prints formulas.

*FreeCalc* makes a very good first impression. The screens are well designed, and the user interface is straightforward and workable. Pick an option from the command list, and *FreeCalc* leads you through a series of questions that allow you to execute your command. This leading process is so effective that you'll have little need to consult the documentation. The Help facility is not context-sensitive, but it does give you a summary description of the commands.

The package comes with three demo spreadsheets that introduce the various functions. Unfortunately, the functions that the program supplies are only slightly less limited than those you'd find on a pocket calculator. *FreeCalc*'s built-in



## FACT FILE



**ExpressCalc, Version 3.14**  
Expressware Corp.  
P.O. Box 230  
Redmond, WA 98073  
(206) 481-3040  
(206) 788-0932

**List Price:** Shareware: \$15 fee includes disks and manual on-disk; \$49 registration fee includes printed manual and disks.

**Requires:** 256K RAM, two disk drives or hard disk, DOS 2.0 or later.

**In Short:** A *SuperCalc*, Version 1, knockoff with a good manual and a shareware price. Contains some sophisticated financial and statistical features such as standard deviations and square roots. Not copy protected.

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February 18, 1987

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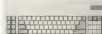
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For The IBM PC.....\$259**

### intel

**8087-3 (5 MHz).....\$129**  
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**80287-8 (8 MHz).....\$269**  
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**FACT FILE**

**FreeCalc, Version 2.0**  
 Stilwell Software  
 Products  
 1336 E. Krista Way  
 Tempe, AZ 85284  
 (602) 820-4952  
 List Price: Shareware:  
 \$10 without documenta-  
 tion; \$47.50 registration fee includes man-  
 ual, disks, FreeCalc Auditor, and telephone  
 support.  
**Requires:** 256K RAM, one disk drive, DOS  
 2.0 or later  
**In Short:** A shareware package with a work-  
 able user interface but very limited functiona-  
 lity. Not copy protected.  
CIRCLE 661 ON READER SERVICE CARD

functions include only sum, average, greatest value, least value, count, and minus, and its operators are confined to add, subtract, multiply, and divide. The package is also unable to have more than one number of decimal places showing in different columns on the spreadsheet: either everything is two decimals (even integers), or dollar amounts have no cents. In addition, the package's editing capabilities are limited, and it offers no graphics. While *FreeCalc* can import and export ASCII files, it will not handle any other format.

To test *FreeCalc*, we tried to use it to do a typical amortization problem: we input the amount borrowed, the interest rate, and the monthly payment at the top of the page. Then we attempted to use those amounts to calculate the monthly interest, the amount of the payment that constitutes principal, and the remaining balance. But the package's limitations made that difficult.

We hit the first snag when we tried to calculate the monthly payment. We tried to set up the spreadsheet so the first cell would be "1" and each subsequent row would be the cell above, plus 1. After entering the first two cells, we expected to be able to use the copy command to duplicate the second cell down the side of the spreadsheet. But the copy command does not allow you to specify the number of copies you wish to make: it makes only one copy.

To make additional copies, the program required us to either enter each formula individually or copy the cell one at a time.


The package does come with a macro Learn function that allows you to record keystrokes. We were able to record the appropriate keystrokes for the copy command. We then repeated them by pressing a single key over and over rather than entering a whole series of keys.

Another limitation is that while most spreadsheets allow you to enter both absolute and relative cell locations into formulas (an absolute location always refers to the same cell address; a relative location allows you to perform the same operation in different cells), *FreeCalc* does not allow you to enter absolute locations into formulas. Hence, you can't perform calculations that require you to refer back to the same cell. In the example we described above, this limitation means that you can't perform calculations using the same interest rate to calculate the payments on various amounts of principal.

Though the designers have done some things right—the user interface and the macro function—what at first looked like a product with real potential turned out to be limited. But because of the price (free; or \$10 from Stilwell without documentation, \$47.50 with documentation), this could be a good place to start for users who are completely inexperienced with spreadsheets and want to learn about them without spending money. To make it even more attractive, Stilwell sells the Software Starter Kit containing *FreeCalc* bundled with a word processor and a file manager. The entire kit with documentation costs \$65.—Donald C. Peckham and Martin L. Ramsay


## InstaCalc QubeCalc

Every so often, the shareware market surprises us by generating an exciting product that can compete head-to-head with its commercial counterparts. FormalSoft's *InstaCalc* and *QubeCalc* are two cases in point. Both products have the same user interface and the same constellation of functions. However, *InstaCalc*, for a suggested contribution of \$49.95, is a two-di-




**FACT FILE**

**EDITOR'S  
CHOICE**



**InstaCalc, Version 2.0**  
 FormalSoft  
 P.O. Box 1913  
 Sandy, UT 84091-1913  
 (801) 565-0971  
**List Price:** Shareware:  
 \$49.95 registration fee.  
**Requires:** 256K RAM,  
 one disk drive, DOS 2.0 or later.  
**In Short:** A memory-resident spreadsheet with a good amount of power and easy file exchange with 1-2-3. Very much worth the cost. Not copy protected.  
CIRCLE 668 ON READER SERVICE CARD



**QubeCalc, Version 3.0**  
 FormalSoft  
 P.O. Box 1913  
 Sandy, UT 84091-1913  
 (801) 565-0971  
**List Price:** Shareware:  
 \$69.95 registration fee.  
**Requires:** 256K RAM,  
 one disk drive, DOS 2.0 or later.  
**In Short:** A three-dimensional shareware spreadsheet. *QubeCalc* also offers a good user interface and a good selection of features, such as a macro processor, plus logical, string, date, and time functions. Not copy protected.  
CIRCLE 669 ON READER SERVICE CARD

mensional RAM-resident spreadsheet, while *QubeCalc* offers three-dimensional-ity for a contribution of \$69.95.

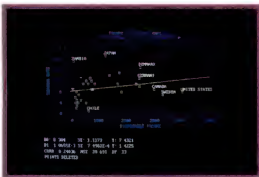
Both spreadsheets give you a 20-line spreadsheet with a status line at the bottom. At the top of the screen, you'll find the current-cell location. You invoke commands using a 1-2-3-type menu in which you can either move the bar or press the first letter of the command to make your selection. While the packages offer nested commands, they give no explanations of the commands. The size of the spreadsheets supported, 256 columns by 256 rows, is generally adequate for all but the largest analyses, and although split screens are not available, you can set column widths to 0 to hide them temporarily in *InstaCalc* (you cannot hide columns with *QubeCalc*).

The packages share an impressive array of features, including all the basic mathematical commands and trigonometric functions, statistical commands (including



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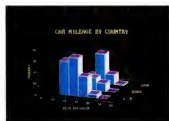
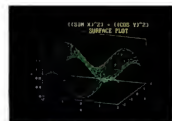
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## ALTERNATIVE ALTERNATIVE SPREADSHEETS

Most spreadsheet products targeted for small-business users are simply chopped spreadsheets, with cut-down features and cut-rate prices. However, we found three products that have nestled into vastly different niches of the small business market from the other products reviewed in this issue.

*Lotus 1-2-3* has jumped on the small-business bandwagon with its recently introduced *Small Business Kit*, consisting of templates that contain sample business plans to help people get up and running in 1-2-3. Cotton Software's *BoxCalc 1000* is for small businesses that want to create proposals chock-full of spreadsheet-type figures and text. SimpleSoft Products *It Figures* lets you calculate problems that contain both words and numbers.

**BOXCALC 1000 FOR BUSINESS PROPOSALS** Cotton Software has developed a whole new way for small-business users to manipulate data. Just as a spreadsheet uses cells, *BoxCalc 1000* uses "boxes" and "blocks" for manipulating data. The boxes can contain a number or a formula that calculates a result based on other boxes. Blocks may contain text. Each box or block is a separate entity residing on a page that you can move and place as necessary. Where a spreadsheet is structured in rows and columns, *BoxCalc* presents you with a blank page; you put the boxes of numbers or calculations and blocks of text where you want them.

According to Cotton Software, this format is good for applications such as business proposals that require both text and figures interspersed in the same document.

The text processing features of *BoxCalc 1000* are powerful and familiar. They include search and replace, underline, bold, headings, footings, page numbering, duplicate, copy, move, and word wrap. In addition, because you can block text in windows, you can create columns of text on the page.

The spreadsheet functions are powerful. Each box is assigned its own number (rather than the row/column designation common for spreadsheets) and can be made to calculate the contents of other boxes, using a typical complement of mathematical functions and operators. In addition, you can pull the contents of boxes that are on other documents into the current document.

*BoxCalc 1000* also offers a powerful programming language (called a calculation procedure) that you can use to manipulate the order in which the boxes are calculated, alter the contents of a cell, and even control the printing of the document down to numbering the pages and manipulating the printer functions. It also offers logical branching with IF logic and GOTO jumping.

As with many of the modest spreadsheets reviewed here, *BoxCalc 1000* is marred by its user interface. For instance, to define all of its functions, the program uses each function key four times (the key itself and with Alt, Shift, and Ctrl)—a system that is both confusing and difficult to learn. Another problem with the user interface is that to load a document you must either type its name or request a directory of available documents. But once you've found the name of the file in the directory, rather than simply pressing the Enter key to call up the listing, you must still type its name.

The manual, while well written, contains no technical reference. You must infer the way in which some of the functions work, and there is no quick reference card.

Who would use *BoxCalc*? Lots of people. Where a spreadsheet is great for rows and columns of calculations, *BoxCalc* addresses the need for calculations within a document that may also contain lots of text. Lawyers who must create the same contracts over and over, with changes to only a few numbers, would like *BoxCalc*. So would accountants and real-estate agents, for the same reason. If

you end up transferring data from your spreadsheet package to your word processor—or, worse, if you end up trying to use your spreadsheet package as a word processor, this package may be just what you have been looking for.

—Donald C. Peckham and Martin L. Ramsay

### IT FIGURES—THE UNSPREADSHEET

The cover of the *It Figures* manual proclaims the product to be "the uns spreadsheet." Rather than using standard rows and columns, *It Figures* is composed of 20 lines. Consequently, there are many spreadsheet-type activities that the product can't perform. For instance, you can't do repeated calculations on rows of numbers or define columns of cells in terms of other columns.

But, according to the vendor, many low-end spreadsheet users don't really need a whole spreadsheet worksheet. Instead, they need a few columns of figures for calculation and some text capabilities to write labels for them. The breadth of uses for *It Figures* is exemplified by its 75 ready-to-run applications for business, home, mathematics, real estate, and finance, as well as applications like break-even analysis, ACRS depreciation, balloon payout, bicycle gear ratios, and linear regression. These are well documented and convenient to use.

To perform your calculations for your own application, you can combine the 47 included functions and operators, such as cosecants, standard deviation, natural logs, and factorials, in various ways in order to compute lengthy, difficult, and complicated combinations of equations. *It Figures* performs calculations with up to 22 digits of accuracy, much higher than the usual 7 or 8. Other functions that let you do a global change of a character string and move a line to a new location make it easy to create applications.

The *It Figures* work area is composed of a title line, the 20 calculation lines, an input area, and a function-key index. The



calculation lines are divided into the formula area, the result area, and the comment area. You enter formulas into the formula area—formulas can be for assigning values to variables, for calculating results based on previously defined variables or on the previous line's results, or combinations along with the powerful built-in functions. The formulas can contain up to three screen-widths of characters. The comment area can be used to document each step.

To overcome the 20-line limit, you can chain files. Formulas can contain IF/THEN branching and GOTO jumps, making it possible to design sophisticated applications. You can store global variables in global variable files so that they can be retrieved by more than one calculation file.

*It Figures* is well designed; it is easy to use and the manual (a sort of ongoing tutorial) is easy to understand and follow.

*It Figures* is a nice cross between a simple spreadsheet and a good pocket calculator with built-in convenience features. For anyone needing to do repeated calculations, this is definitely a package to take a look at.—Donald C. Peckham and Martin L. Ramsay

**LOTUS—A KIT FOR SMALL BUSINESSES** With its *Lotus 1-2-3 Small Business Kit*, Lotus hopes to lure the small-business user—not with a revolutionary new program but with 1-2-3 clout. Bundled with 1-2-3, Release 2.01, the \$595 *Small Business Kit* contains six financial templates and a generous dose of customer support.

The templates, created by the Lotus staff after considerable marketing research and advice from a variety of small businesses and professional organizations, include three spreadsheet analysis models (cash flow from operations, source and use of cash, and financial ratio and cost-profit) and two what-if planning models (cash budget model and *pro forma* financial model). These templates

## FACT FILE



**BoxCalc 1000,**  
Version 1.06  
Conson Software Inc.  
2325 Anderson Rd.,  
#364  
Covington, KY 41017  
(606) 727-1600  
List Price: \$99

**Requires:** 256K RAM, one disk drive, DOS 2.0 or later.

**In Short:** A niche product for small-business users who want to write proposals that include combined text and figures. Not copy protected.

CIRCLE 60 ON READER SERVICE CARD



**It Figures,**  
Version 2.0  
SimpleSoft  
Products Inc.  
P.O. Box 13173  
Boulder, CO 80308  
(303) 444-8771  
List Price: \$49.95

**Requires:** 192K RAM, one disk drive, DOS 1.0 or later.

**In Short:** Not exactly a spreadsheet, this product includes 20 lines, but no rows or columns. It does, however, contain a large number of mathematical functions for problems that require extensive calculations. Not copy protected.

CIRCLE 61 ON READER SERVICE CARD



**Lotus 1-2-3 Small Business Kit**  
Lotus Development Corp.  
55 Cambridge Pkwy.  
Cambridge, MA  
02142  
(617) 577-8500

List Price: \$595

**Requires:** 256K RAM; one disk drive; DOS 2.0 or later in 5¼-inch system, DOS 3.2 or later in 3½-inch system.

**In Short:** A package tailored to the needs of small businesses. Included is *Lotus 1-2-3*, Release 2.01, combined with a set of financial analysis and planning templates, and a special customer support service. Copy protected.

CIRCLE 62 ON READER SERVICE CARD

are designed to help users with no experience in designing spreadsheets to perform complex analyses and projections.

To use the templates, you install and boot up in 1-2-3. The template files automatically appear following the /File-Retrieve command. The templates are attractively designed and well defined—all you have to do is plug in the appropriate data. According to Lotus, you can call all of the input for the spreadsheets from your business's balance sheet and income statement.

The *Kit* comes with 6 months of unlimited customer support. Lotus has installed a toll-free telephone line catering exclusively to *Small Business Kit* users. According to the company, the specialized support is needed because most small-business operations, unlike the larger corporations, have no resident 1-2-3 maven to field user questions. The *Small Business Kit* documentation also includes a directory of local and regional Small Business Administration office centers. Presumably the user can contact the SBA to help tussle with business-management problems that the 1-2-3 staff couldn't handle. Lotus is also planning a series of regional seminars, co-sponsored by local SBA centers and local retailers.

Lotus faces some obstacles before it penetrates this relatively untapped market sector. The major obstacle is that you can't purchase the templates separately from the spreadsheet. Therefore, people who already own 1-2-3 won't be motivated to make use of them.

We've also got to wonder about the needs of small-business users as dictated by the nature of their business. Perhaps users want a leg up to a heavy-duty spreadsheet, as Lotus is betting with this *Small Business Kit*. Or maybe they really need a smattering of applications, with no in-depth analysis applications, as in *Microsoft Works* and Software Publishing's *PFS:First Choice*.

—Robin Raskin



## ■ LOW-END SPREADSHEETS

average, minimum, and maximum), standard deviations, and variances. Their financial functions include future value, present value, payment per period, and growth rate. The packages' logical IF, date, time, and string functions are features rarely found in inexpensive packages.

The AutoCalc function is a nice feature of both packages in that it allows each

### ■ *InstaCalc* and *QubeCalc* offer features rarely found in inexpensive spreadsheet packages.

package to perform calculations only on a specified range, allowing it to perform those calculations more quickly than if it had to consider the entire spreadsheet. The Range Modify command is particularly useful for what-if analysis. With this command, you can apply a certain computation to all the numbers in a marked range.

An attractive macro processor included with the package has several macro-specific commands for such things as prompting for and accepting user input, or branching and looping. The macro processor, however, does not include a learn mode. Macros are stored inside the spreadsheet.

Graphics are available, though rudimentary. Your choices are limited to bar and line in CGA mode only. You can, however, define the ranges, legends, titles, labels, and format of the number and control the spacing of the values along the axis.

The import/export capabilities of these packages are excellent. DIF, I-2-3-format (1A and 2), and dBASE files are supported, and you can export to ASCII with a Print File command. At this point no ASCII import is possible, although FormalSoft plans it for an upcoming release.

The documentation for both products is unremarkable but adequate.

**INSTACALC** As a memory-resident package, *InstaCalc* shines. *InstaCalc* may be configured to use up to 580K, with the

program itself consuming 85K, and the basic configuration that includes room for the worksheet, 128K. The primary advantage of this RAM-resident package is that it allows you to exchange information with your foreground application. To import data into the spreadsheet, you invoke the spreadsheet, place the cursor at the location where you'll want to place the data, then toggle out to your application with the F7 key. A pop-up box that remains on the screen in your application tells you how to highlight the data for export into the spreadsheet.

Exporting data from the spreadsheet to the application works the same way. However, make sure you understand the conventions used by the application you're exporting to; some editors need to have tabbing set off, or the data will get stuck at the beginning of the second line.

**QUBECALC** Though *QubeCalc* shares the same user interface and basic functions of *InstaCalc*, it is built around a 64 by 64 by 64 "Workcube." In this cube, you specify addresses by row, column, and page, although if you fail to specify the page, it defaults to the current one.

Using the Perspective subcommand under the Workcube choice on the main I-2-3-style menu, you can choose to view either all the data on a single spreadsheet, or cut across spreadsheets looking at all the data in a particular row or column. You can view the data along any of the six Qube "faces," labeled A through F. If, for example, you had a four-column page on face A that listed quarterly results for a division and the pages were other divisions, looking at face B would allow you to page through to the second-quarter results with a view of all the divisions on one screen. The program accomplishes this quickly, and you won't feel as if you're waiting to load the data before you can view it.

Since each *QubeCalc* cell participates in many virtual spreadsheets, the format used is that of the widest nonblank cell in all of the linked spreadsheets. The program protects you against doing something on one page that would affect something on another in a destructive way. You cannot, therefore, hide a row or column by making its width 0 because of the effect that would have on other faces.

**SUMMARY** *InstaCalc* and *QubeCalc* offer a great deal of capability compared with many of the other packages reviewed here. If you want a two-dimensional RAM-resident spreadsheet or a multidimensional spreadsheet with a sizable amount of power at a very reasonable price, you should definitely consider *InstaCalc* and *QubeCalc*.—Merv Adrian

## Number Works

*Number Works*, from Paperback Software, is a very inexpensive (\$39.95) package that offers only the most basic spreadsheet functions. If you want more features for a low price, Paperback Software offers *VP-Planner* for \$99.95. *VP-Planner* is the full-featured I-2-3, Release 1A, clone that has recently received attention because of Lotus's look-and-feel lawsuit against it and against Mosaic Software's *The Twin*.

Like other packages in Paperback Software's product line, *Number Works* comes packaged like a trade paperback with a disk tucked into the back. The manual documents every keystroke and is very appealing to the novice user, since it includes practice sessions as it introduces new concepts. However, more-experienced users may find the manual a little tedious when trying to find a brief synopsis of a particular command.

Most spreadsheets allocate memory as they go: you define a cell, and a little piece of RAM is carved out for it. But when you define a spreadsheet using *Number Works*,



## FACT FILE



*Number Works*,  
Version 1.0  
Paperback Software  
2830 Ninth St.  
Berkeley, CA 94710  
(415) 644-2116  
List Price: \$39.95  
Requires: 128K RAM,

one disk drive, DOS 2.0 or later.  
**In Short:** An inexpensive package with only the most basic functionality. Inconvenient is the fact that *Number Works* accounts formulas only up to 42 characters long. Copy protected.

CIRCLE 627 ON READER SERVICE CARD





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## ■ LOW-END SPREADSHEETS

you must first specify the total size of the work area in rows and columns (this area can be expanded later). The allowable file size depends only on the capacity of your disk drive. *Number Works* requires only 128K to run but will still allow massive spreadsheets of up to 9,999 rows by 9,999 columns. This is possible because most of the file resides on disk, with only the active portion of the file in RAM. The downside is a high number of disk accesses and, consequently, slow speed.

We tested this capability by telling the software that we wanted a spreadsheet that was 9,999 rows by 9,999 columns. The software told us that we did not have enough file capacity on our disk. When we reduced our expectations and asked for a 100 by 500 spreadsheet size, the package took 10 minutes to create the file, which took over 3MB of disk space.

While *VP-Planner* offers all of the *Lotus 1-2-3*, Release 1A, features and more, *Number Works* offers roughly 40 percent of *Lotus 1-2-3's* functionality. It offers 13 mathematical functions, including pi, exponential functions, and all trigonometric functions, as well as minimum and maximum. Its financial functions are limited to present value, and it offers the logical IF function.

Inconveniently, formulas may be only 42 characters long. The cursor simply stops and the computer beeps at you if you try to enter a longer formula. To work around this, you must break the formula into logical components and place them in different cells for later combination.

One of the more serious problems with *Number Works* (one that it shares with many other small spreadsheet packages) is the inability to define formulas for cells with a combination of absolute and relative references. You can have one or the other in a formula, but not both.

*Number Works* can print a defined area of up to 132 columns of output to a printer. It will also generate ASCII files to go to your word processor; however, it does not import or export any 1-2-3 or DIF files. The package has no graphics or macro capabilities.

If you get into trouble with *Number Works*, the Paperback Software people will be glad to help you out—for a price. Technical support costs \$1 per minute,

with a \$5 minimum. But the manual is clear enough so that most users should be able to get by with the help of a technical friend. And *Number Works* itself is a solid little spreadsheet—though no competition for *Lotus*. But then again, at its price, you could do a lot worse.—Donald C. Peckham and Martin L. Ramsay

## Integrated Packages

### DeskMate II

Tandy Corp.'s *DeskMate II* is a \$99.95 RAM-resident integrated package. In this role, it acts as a useful assistant who waits patiently for your Alt = call, then springs into action with spreadsheet, word processing, filing, telecommunications, calendar, mail manager, and other desktop capabilities.

You access each of these functions from a pop-up main menu that displays the currently available files from each one. To select a file, you simply highlight the desired file or type in a new name, and off you go! You transfer data from one function to another as an ASCII file.

The problem with *DeskMate II* is that none of its functions are very powerful or large (the software, DOS, and the current file being worked with can occupy no more than 128K), and the entire package is certainly no match for the big integrated packages like *Symphony* or *Smart*.

The spreadsheet work area is 99 rows

by 99 columns, which is large enough for rudimentary functions but inadequate for handling large or complex tasks.

The math functions are rudimentary and include addition, subtraction, sums of columns and rows, and averages of columns and rows. While the package does contain a few trigonometric functions, there are no financial, statistical, or text manipulation functions, or any logical operands. A serious omission is the ability to perform a function on a specified area of the spreadsheet. You can, for example, sum a column of numbers, but only from a specified row down to the current row. You can't sum a column of cells that is below the current cell or a row of cells that is to the left. In addition, the package only allows you to sum single rows or columns—you cannot sum a block of cells. These deficiencies hold true for the other functions such as average, minimum, and maximum. The package offers no graphics or macro capabilities.

Another problem with *DeskMate II* is its speed. While we were unable to do the PC Labs performance tests on this product because it couldn't handle the matrix mathematics in the tests, we can say that it is slow—there was enough time to read an entire *PC Magazine* review while waiting for an 8-row by 60-column spreadsheet to load. This takes away from the value of having *DeskMate II* hiding in the background. Hotkeying into *DeskMate II* to add a few quick figures to a ledger spreadsheet takes longer than loading some other spreadsheet software and a data file from scratch.

*DeskMate II* is certainly less expensive than its big-brother competitors, and it may be just the thing for someone who needs minimal assistance from a combination of functions—spreadsheet, word processor, and the like. At some point though, many users may outgrow it and look longingly at some of the more-powerful "big bucks" packages.

In fact, Tandy has announced the upcoming release of *DeskMate Professional* for higher-end users; the product was unavailable for review in this issue but should be available by the time this article is published. Though the names are similar, the new product will serve as a work-group manager for a network and will contain

**FACT FILE**



*DeskMate II*,  
Version 1.00  
Tandy Corp.  
1800 One Tandy Ctr.  
Fort Worth, TX 76102  
(817) 390-3700  
List Price: \$99.95  
Requires: 128K RAM,  
one disk drive, DOS 2.0 or later.

In Short: A RAM-resident integrated package that includes a spreadsheet, word processor, filer, communications, calendar, mail manager, and more. None of *DeskMate II's* functions are very powerful or large. Not copy protected.

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**The new  
8-page/minute  
QMS-PS 800 II  
laser printer**

## The PostScript laser printer sure to get high ratings at its network debut.

The QMS-PS<sup>®</sup> 800 II is an 8-page-per-minute laser printer that combines the desktop publishing power of Adobe PostScript<sup>®</sup> with the superior printer technology of QMS, a leader in printer technology for 10 years. Exceptional paper handling, faster processing speed and a Canon<sup>®</sup> CXD<sup>®</sup> print engine with 10,000-page-per-month duty cycle give QMS-PS 800 II the versatility you need on your PC network.

**A network sensation** QMS-PS 800 II holds 500 pages, so operators aren't constantly refilling depleted paper trays. Users can even designate automatic switching between the two trays for doing letterhead/second page printing. Select faceup or facedown collation. And manually feed odd-sized paper stock.

With QMS ASAP<sup>™</sup> (Advanced System Architecture for PostScript) proprietary technology, QMS-PS 800 II delivers outstanding performance. In fact, the more complex the page, the more it outperforms other PostScript printers. Two megabytes of memory, expandable to three megabytes, also add to the overall page processing speed when you are creating complex documents.

**Type casting** The QMS-PS 800 II comes with 35 resident typefaces (you can download more if you like). PostScript allows you to scale type to virtually any size, from minuscule to mammoth. PostScript also enables you to design, and redesign, your documents with exacting detail. You have total control over the final appearance of documents, with the ability to place text and graphics anywhere on the page. In short, you get the complete desktop publishing power that only PostScript can give you.

**Critical acclaim** The QMS-PS 800 II is certain to receive rave reviews on your network. And for a single-user set-up, there's the QMS-PS 810 laser printer. For a demonstration of either, call **1-800-523-2696** for the location of the Laser Connection dealer nearest you. And be sure to ask for *The Sourcebook*<sup>™</sup> - our exclusive catalog filled with the latest laser printer products and enhancements.

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## THE GOOD, THE BAD, AND THE FUNCTIONAL

If you're a spreadsheet user needing just a fraction of the features of powerhouse packages like 1-2-3, the programs reviewed here offer most of the features and functions you'll want for many applications, free of requirements for fancy equipment or time-consuming training. And as you can see in the screens shown here, many do so in a user-friendly way with pop-up help.

On the other hand, you'll find that though the user interfaces of some of the standalone products are novel, novelty alone doesn't ensure functionality. And while some of the integrated programs offer a hassle-free way to move among applications, others suffer from a problem typical of modular packages—a limited degree of data integration and functional similarity between applications or modules.

Most of these packages also lack real graphics features. Others eliminate such extras as linked spreadsheets and a sparse memory matrix design. And with the notable exception of *Number Works*, none come anywhere near 1-2-3's 256-column by 8,192-row workspace.

A	B	C	D	E	F	G
100.00	110.00	121.00	133.10	146.41	161.05	177.05
110.00	121.00	133.10	146.41	161.05	177.05	194.48
121.00	133.10	146.41	161.05	177.05	194.48	213.54
133.10	146.41	161.05	177.05	194.48	213.54	234.26
146.41	161.05	177.05	194.48	213.54	234.26	256.68
161.05	177.05	194.48	213.54	234.26	256.68	280.85
177.05	194.48	213.54	234.26	256.68	280.85	306.84
194.48	213.54	234.26	256.68	280.85	306.84	334.73
213.54	234.26	256.68	280.85	306.84	334.73	364.60
234.26	256.68	280.85	306.84	334.73	364.60	396.63
256.68	280.85	306.84	334.73	364.60	396.63	430.00
280.85	306.84	334.73	364.60	396.63	430.00	464.81
306.84	334.73	364.60	396.63	430.00	464.81	500.16
334.73	364.60	396.63	430.00	464.81	500.16	537.14
364.60	396.63	430.00	464.81	500.16	537.14	575.85
396.63	430.00	464.81	500.16	537.14	575.85	616.38
430.00	464.81	500.16	537.14	575.85	616.38	658.81
464.81	500.16	537.14	575.85	616.38	658.81	703.24
500.16	537.14	575.85	616.38	658.81	703.24	749.75
537.14	575.85	616.38	658.81	703.24	749.75	798.44
575.85	616.38	658.81	703.24	749.75	798.44	849.41
616.38	658.81	703.24	749.75	798.44	849.41	901.76
658.81	703.24	749.75	798.44	849.41	901.76	955.59
703.24	749.75	798.44	849.41	901.76	955.59	1010.90
749.75	798.44	849.41	901.76	955.59	1010.90	1067.79
798.44	849.41	901.76	955.59	1010.90	1067.79	1126.26
849.41	901.76	955.59	1010.90	1067.79	1126.26	1186.41
901.76	955.59	1010.90	1067.79	1126.26	1186.41	1248.24
955.59	1010.90	1067.79	1126.26	1186.41	1248.24	1311.85
1010.90	1067.79	1126.26	1186.41	1248.24	1311.85	1377.24
1067.79	1126.26	1186.41	1248.24	1311.85	1377.24	1444.41
1126.26	1186.41	1248.24	1311.85	1377.24	1444.41	1513.36
1186.41	1248.24	1311.85	1377.24	1444.41	1513.36	1584.09
1248.24	1311.85	1377.24	1444.41	1513.36	1584.09	1656.60
1311.85	1377.24	1444.41	1513.36	1584.09	1656.60	1730.99
1377.24	1444.41	1513.36	1584.09	1656.60	1730.99	1807.26
1444.41	1513.36	1584.09	1656.60	1730.99	1807.26	1885.41
1513.36	1584.09	1656.60	1730.99	1807.26	1885.41	1965.44
1584.09	1656.60	1730.99	1807.26	1885.41	1965.44	2047.35
1656.60	1730.99	1807.26	1885.41	1965.44	2047.35	2131.14
1730.99	1807.26	1885.41	1965.44	2047.35	2131.14	2216.81
1807.26	1885.41	1965.44	2047.35	2131.14	2216.81	2304.36
1885.41	1965.44	2047.35	2131.14	2216.81	2304.36	2393.79
1965.44	2047.35	2131.14	2216.81	2304.36	2393.79	2485.00
2047.35	2131.14	2216.81	2304.36	2393.79	2485.00	2577.99
2131.14	2216.81	2304.36	2393.79	2485.00	2577.99	2672.76
2216.81	2304.36	2393.79	2485.00	2577.99	2672.76	2769.31
2304.36	2393.79	2485.00	2577.99	2672.76	2769.31	2867.64
2393.79	2485.00	2577.99	2672.76	2769.31	2867.64	2967.75
2485.00	2577.99	2672.76	2769.31	2867.64	2967.75	3069.64
2577.99	2672.76	2769.31	2867.64	2967.75	3069.64	3173.31
2672.76	2769.31	2867.64	2967.75	3069.64	3173.31	3278.76
2769.31	2867.64	2967.75	3069.64	3173.31	3278.76	3385.99
2867.64	2967.75	3069.64	3173.31	3278.76	3385.99	3494.90
2967.75	3069.64	3173.31	3278.76	3385.99	3494.90	3605.49
3069.64	3173.31	3278.76	3385.99	3494.90	3605.49	3717.76
3173.31	3278.76	3385.99	3494.90	3605.49	3717.76	3831.71
3278.76	3385.99	3494.90	3605.49	3717.76	3831.71	3947.34
3385.99	3494.90	3605.49	3717.76	3831.71	3947.34	4064.65
3494.90	3605.49	3717.76	3831.71	3947.34	4064.65	4183.64
3605.49	3717.76	3831.71	3947.34	4064.65	4183.64	4304.31
3717.76	3831.71	3947.34	4064.65	4183.64	4304.31	4426.64
3831.71	3947.34	4064.65	4183.64	4304.31	4426.64	4550.64
3947.34	4064.65	4183.64	4304.31	4426.64	4550.64	4676.31
4064.65	4183.64	4304.31	4426.64	4550.64	4676.31	4803.64
4183.64	4304.31	4426.64	4550.64	4676.31	4803.64	4932.64
4304.31	4426.64	4550.64	4676.31	4803.64	4932.64	5063.31
4426.64	4550.64	4676.31	4803.64	4932.64	5063.31	5195.64
4550.64	4676.31	4803.64	4932.64	5063.31	5195.64	5329.64
4676.31	4803.64	4932.64	5063.31	5195.64	5329.64	5465.31
4803.64	4932.64	5063.31	5195.64	5329.64	5465.31	5602.64
4932.64	5063.31	5195.64	5329.64	5465.31	5602.64	5741.64
5063.31	5195.64	5329.64	5465.31	5602.64	5741.64	5882.31
5195.64	5329.64	5465.31	5602.64	5741.64	5882.31	6024.64
5329.64	5465.31	5602.64	5741.64	5882.31	6024.64	6168.64
5465.31	5602.64	5741.64	5882.31	6024.64	6168.64	6314.31
5602.64	5741.64	5882.31	6024.64	6168.64	6314.31	6461.64
5741.64	5882.31	6024.64	6168.64	6314.31	6461.64	6610.64
5882.31	6024.64	6168.64	6314.31	6461.64	6610.64	6761.31
6024.64	6168.64	6314.31	6461.64	6610.64	6761.31	6913.64
6168.64	6314.31	6461.64	6610.64	6761.31	6913.64	7067.64
6314.31	6461.64	6610.64	6761.31	6913.64	7067.64	7223.31
6461.64	6610.64	6761.31	6913.64	7067.64	7223.31	7380.64
6610.64	6761.31	6913.64	7067.64	7223.31	7380.64	7539.64
6761.31	6913.64	7067.64	7223.31	7380.64	7539.64	7700.31
6913.64	7067.64	7223.31	7380.64	7539.64	7700.31	7862.64
7067.64	7223.31	7380.64	7539.64	7700.31	7862.64	8026.64
7223.31	7380.64	7539.64	7700.31	7862.64	8026.64	8192.31
7380.64	7539.64	7700.31	7862.64	8026.64	8192.31	8359.64
7539.64	7700.31	7862.64	8026.64	8192.31	8359.64	8528.64
7700.31	7862.64	8026.64	8192.31	8359.64	8528.64	8699.31
7862.64	8026.64	8192.31	8359.64	8528.64	8699.31	8871.64
8026.64	8192.31	8359.64	8528.64	8699.31	8871.64	9045.64
8192.31	8359.64	8528.64	8699.31	8871.64	9045.64	9221.31
8359.64	8528.64	8699.31	8871.64	9045.64	9221.31	9398.64
8528.64	8699.31	8871.64	9045.64	9221.31	9398.64	9577.64
8699.31	8871.64	9045.64	9221.31	9398.64	9577.64	9758.31
8871.64	9045.64	9221.31	9398.64	9577.64	9758.31	9940.64
9045.64	9221.31	9398.64	9577.64	9758.31	9940.64	10124.31
9221.31	9398.64	9577.64	9758.31	9940.64	10124.31	10309.64
9398.64	9577.64	9758.31	9940.64	10124.31	10309.64	10496.31
9577.64	9758.31	9940.64	10124.31	10309.64	10496.31	10684.64
9758.31	9940.64	10124.31	10309.64	10496.31	10684.64	10874.31
9940.64	10124.31	10309.64	10496.31	10684.64	10874.31	11065.64
10124.31	10309.64	10496.31	10684.64	10874.31	11065.64	11258.64
10309.64	10496.31	10684.64	10874.31	11065.64	11258.64	11453.31
10496.31	10684.64	10874.31	11065.64	11258.64	11453.31	11649.64
10684.64	10874.31	11065.64	11258.64	11453.31	11649.64	11847.64
10874.31	11065.64	11258.64	11453.31	11649.64	11847.64	12047.31
11065.64	11258.64	11453.31	11649.64	11847.64	12047.31	12248.64
11258.64	11453.31	11649.64	11847.64	12047.31	12248.64	12451.31
11453.31	11649.64	11847.64	12047.31	12248.64	12451.31	12655.64
11649.64	11847.64	12047.31	12248.64	12451.31	12655.64	12861.64
11847.64	12047.31	12248.64	12451.31	12655.64	12861.64	13069.31
12047.31	12248.64	12451.31	12655.64	12861.64	13069.31	13278.64
12248.64	12451.31	12655.64	12861.64	13069.31	13278.64	13489.64
12451.31	12655.64	12861.64	13069.31	13278.64	13489.64	13701.31
12655.64	12861.64	13069.31	13278.64	13489.64	13701.31	13914.64
12861.64	13069.31	13278.64	13489.64	13701.31	13914.64	14129.64
13069.31	13278.64	13489.64	13701.31	13914.64	14129.64	14346.31
13278.64	13489.64	13701.31	13914.64	14129.64	14346.31	14564.64
13489.64	13701.31	13914.64	14129.64	14346.31	14564.64	14784.31
13701.31	13914.64	14129.64	14346.31	14564.64	14784.31	15005.64
13914.64	14129.64	14346.31	14564.64	14784.31	15005.64	15228.64
14129.64	14346.31	14564.64	14784.31	15005.64	15228.64	15453.31
14346.31	14564.64	14784.31	15005.64	15228.64	15453.31	15679.64
14564.64	14784.31	15005.64	15228.64	15453.31	15679.64	15907.64
14784.31	15005.64	15228.64	15453.31	15679.64	15907.64	16137.31
15005.64	15228.64	15453.31	15679.64	15907.64	16137.31	16368.64
15228.64	15453.31	15679.64	15907.64	16137.31	16368.64	16601.31
15453.31	15679.64	15907.64	16137.31	16368.64	16601.31	16835.64
15679.64	15907.64	16137.31	16368.64	16601.31	16835.64	1707

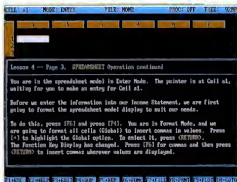




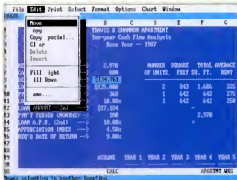


## ■ LOW-END SPREADSHEETS

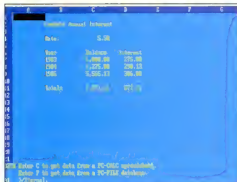
("The Good, the Bad, and the Functional" continued)



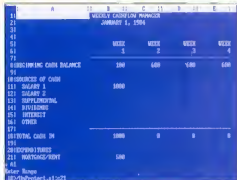
One of Harmony Spreadsheet's most helpful features is its interactive tutorial. You can get hands-on experience while working in the spreadsheet displayed at the top of the screen. The bottom half of the screen displays instructions that guide you through the session.



With Microsoft Works, you can create spreadsheets of up to 256 columns by 4,096 rows. You access the spreadsheet commands through pull-down menus that are activated by pressing the Alt key. The contents of the active cell are displayed in the formula bar near the upper-left-hand corner.

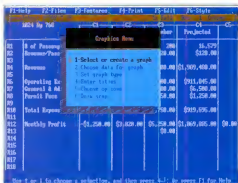


Importing data into PC-Calc from other PC-Calc worksheets or from ButtonWare's PC-File database program is easy—you just select a command from the menu. The program also directly imports ASCII and .DIF files, but it neither imports nor exports 1-2-3 files.

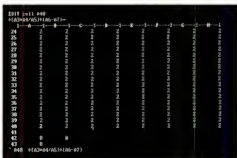


The interface of PeachText 5000's PeachCalc could stand some updating. For instance, rather than simply providing a point mode, PeachCalc requires you to specify a range of data by typing in the row and column designation.

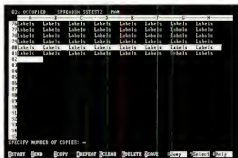




The latest version of PFS:First Choice includes well-executed graphics that integrate beautifully with your spreadsheet. You choose the data to be graphed simply by pointing to its cell ranges while working within your spreadsheet application.



THE Spreadsheet has a number of blemishes, the most obvious of which is its screen design. The program uses ASCII characters to create its screen displays and doesn't take advantage of color.



Spreadsheet for the IBM PC, XT, and AT does not have the friendliest interface. For instance, the copy procedure, shown above, requires you to highlight the cells you want to copy, then place the cursor on the spot that you want to copy them to. The program doesn't ask for the destination range of cells you are copying. Instead, it asks for the number of lines you are copying them to, starting at the cursor position.



## ■ LOW-END SPREADSHEETS

such features as work-group calendars, electronic mail, shared phone lists, and a shared spreadsheet.—Donald C. Peckham and Martin L. Ramsay

### Electric Desk

In an industry in which making a lunch date for next week seems like long-range planning, Alpha Software Corp.'s *Electric Desk*, which sells for \$129, is an inveterate survivor. The program, which has been on the market since 1984, comes bundled with a large number of PC clones, including machines from Hyandai and Cordata. Admittedly, *Electric Desk* suffers from a few inexcusable eccentricities, such as a poor user interface and rather awkward function-key assignments. But the spreadsheet portion of the program satisfactorily calculates simple linear formulas, formats cells, copies and moves rows and columns, and works with multiple spreadsheets, making it an acceptable tool for both novices and users with only modest spreadsheet requirements.

The package includes a spreadsheet, database, telecommunications, and word processor programs, all of which are referred to as "services." A dictionary and thesaurus module is available for an additional \$50. *Electric Desk* caters to users of moderate hardware means by offering two installation options. A smaller (256K) version uses overlays, which marginally in-

creases the time it takes to switch between applications; the larger version requires 384K and holds more data files in RAM. Memory permitting, you can easily work with several services at once, or with multiple files within a single service at the same time (as many as nine open files within the spreadsheet function).

Though the broad range of services is welcome, *Electric Desk*'s user interface would benefit from a face-lift. A display screen listing nine function-key commands is located at the top of all service displays. You access submenus by hitting any one of these nine keys, whose functions change at every succeeding level. This constant fluctuation in function-key values makes it impossible for them to be as easily memorizable as 1-2-3's mnemonic command structure. Even experienced *Electric Desk* users need to peruse these often less-than-intuitive command menus as if they were seeing things for the first time.

Besides these screen-based commands, the spreadsheet service offers a host of Ctrl- and Alt-key combinations that speed up selection and bypass the function keys. However, these key assignments are not well grounded in PC tradition. For example, the Help key is an awkward Alt-F5. Other terminology also strays from the established PC software path. Windows are called viewpoints, combining spreadsheets or portions of spreadsheets is called overlaying, and a catchall of miscellaneous commands is found under an F9 Environments menu. You distinguish absolute and relative references by using uppercase or lowercase letters in the Row and Column notation, and use the F1 and F2 keys to move the cursor right and left while editing a formula. Everything you need in order to create spreadsheets is there; it's just a little quirky.

The spreadsheet service features a 2,048-column, 255-row worksheet. Eighteen rows and 9 columns of the worksheet are displayed on-screen below the main menu. The bottom of the screen contains a single-line dialog area that displays messages, queries you, records formulas, or provides information regarding memory. The bottom line of the screen contains a menu accessing all of *Electric Desk*'s other services.

**IMPORT/EXPORT** While the program does not import from 1-2-3, it can import and export ASCII and .DIF files. Since the PC Labs performance tests are in 1-2-3 format, it was necessary to enter the data manually. The first goal of the benchmark test was to calculate the square root of 4, which the program determined to be 1.9999. However, changing the default to integer style eliminated the confusion. I also discovered that *Electric Desk* has no built-in mathematical precedence. Rather than following typical algebraic logic (multiply first, then divide, and so on), the program merely read my formula from left to right. It was necessary for me to insert parenthetical expressions manually to force the program to read the formula in the correct order.

Despite the eccentricities, you should have little problem creating and editing a simple spreadsheet. A cell-pointing mode lets you quickly enter cell locations in a formula. A comprehensive set of statistical, algebraic, mathematical, and financial functions facilitates formula creation. A well-executed macro command records keystrokes to generate macros. You can view two spreadsheets simultaneously and work on them independently. The program can also copy data between components, drop to DOS, size windows, and perform other surprisingly sophisticated features, including sorting, protecting cells, and locking spreadsheet titles. The package, however, offers no graphics capabilities.

Alpha Software is currently planning the release of *Office Works*, a completely modernized office-productivity solution. With a graphical interface, 1-2-3 file compatibility, EMS support, and other sophistications, *Office Works* could become the "Thoroughly Modern Millie" of Alpha Software.

Though the company plans to continue selling *Electric Desk*, users who need more-advanced functions might want to check out *Office Works*, which will be priced at about \$200. *Electric Desk*'s spreadsheet is fine if you're not planning to do anything more than simple spreadsheet functions, but compared with some of the others on the market, it's awkward. Most users will find it a bargain only if it comes bundled with their PC.—Robin Raskin



### FACT FILE



*Electric Desk*,  
Version 1.1  
Alpha Software Corp.  
One North Ave.  
Burlington, MA 01803  
(617) 229-2924  
List Price: \$129; \$179  
with spelling checker and  
thesaurus.

Requires: 256K RAM, one disk drive, DOS 2.0 or later.

**In Short:** An integrated package with a robust set of capabilities, the spreadsheet component is easy to use and reasonably powerful, but somewhat old-fashioned. Not copy protected.

CIRCLE 663 ON READER SERVICE CARD



## Harmony Spreadsheet

*Harmony Spreadsheet* is part of a much larger set of modular—mostly accounting—application programs for small-to-medium-sized businesses from Open Systems. These modules include accounts payable, accounts receivable, general ledger, payroll, purchasing, order entry, inventory, information management, client accounting, and word processing. Each module is sold separately but must run under the \$99 system manager module that coordinates all of the other modules, which means that the total price of the \$99 *Harmony Spreadsheet* would be \$198. Prices for the other modules range from \$99 to \$999.

*Harmony Spreadsheet* is marketed as a productivity tool that is designed to work with data from, and has the same interface as, the other modules.

The spreadsheet has a good user interface, including context-sensitive help. In addition, the package offers an interactive tutorial. As with the tutorial offered in *Lotus 1-2-3*, Release 1A, you learn by working on the actual screens of the software as the tutorial leads you through one lesson after another.

The functions offered are adequate and include absolute values, integers, fractions, and all the trigonometric functions.

The financial functions offered include internal rate of return and future value.

The product's editing features are rather limited. For instance, *Harmony Spreadsheet* distinguishes between duplication

and replication of cells in the worksheet. Duplication copies cells in an absolute way—if a formula in row 1 column E references row 3 column A, then duplicating the formula down to row 2 column E will

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MIRROR II is designed for use on IBM and 100% compatible microcomputers including the IBM PC/XT and running MS DOS 1.1 / PC DOS 2.0 or higher and is not copy protected.



## FACT FILE



**Harmony Spreadsheet,  
Version 2.03**  
Open Systems Inc.  
A Convergent Co.  
6477 City West Pkwy.  
Minneapolis, MN 55344  
(612) 829-0011  
List Price: \$99, required

System Manager program, \$99.  
Requires: 512K RAM, hard disk drive, System Manager, DOS 2.1 or later.

**In Short:** Part of a modular accounting system for small businesses, *Harmony Spreadsheet* has a good user interface (including context-sensitive help) and an adequate number of functions, including bar graphs. However, it makes a rather expensive choice unless purchased to work with other *Harmony* modules. Not copy protected.

CIRCLE 66 ON READER SERVICE CARD

CIRCLE 478 ON READER SERVICE CARD



## ■ LOW-END SPREADSHEETS

still reference row 3 column A. If the cell is replicated, the new formula would reference row 4 column A. Once you understand this distinction, you can use these functions effectively.

However, if you are using both duplication and replication, you can copy only a single row or column at a time. You cannot copy a range of cells to another area or a single cell to a block of cells.



*Harmony Spreadsheet* has a built-in graphing function, but again it is rather limited. This function provides bar graphs in eight colors. You can save your graph as an image to be included in a document in the word processing module. Unfortunately, you can't save the definition of the graph (the columns or rows being graphed, the colors of the bars, and so on). As a result, you must reenter the graph's specifications each time you want to look at the graphed numbers.

*Harmony Spreadsheet* is better than the

average spreadsheet reviewed here, particularly because of the good help, adequate functions, and the graphing component. To a user who already owns the system manager module and one or two other *Harmony* components, *Harmony Spreadsheet* would make a very useful addition. But for a user who is simply looking for a spreadsheet, *Harmony* would not be a good choice because of the expense involved in purchasing both the spreadsheet module and the system manager module. There are less-complex, less-expensive ways to acquire a good spreadsheet package. —Donald C. Peckham and Martin L. Ramsay

## Microsoft Works

*Microsoft Works* is a well-integrated package that combines a spreadsheet with word processing, database, and communications capabilities. Not only does the *Works*



EDITOR'S  
CHOICE

FACT FILE

**Microsoft Works,  
Version 1.0**  
Microsoft Corp.  
Box 97017  
16011 NE 36th Way  
Redmond, WA 98073-  
9717  
(206) 882-8080

**List Price:** \$195  
**Requires:** 384K RAM; one 720K disk drive,  
two 360K drives, or hard disk; DOS 2.0 or  
later.

**In Short:** A well-integrated package with a  
relatively powerful spreadsheet. *Microsoft  
Works* includes numerous math and financial  
functions and the ability to graph data, as well  
as good file exchange with *Lotus 1-2-3*. In-  
terestingly, the package can open up to eight  
files of any type simultaneously. Not copy  
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spreadsheet include all the features that all but power users will ever need, including good graphics and macros, but the program costs just \$195.

Microsoft Corp. did a nice job of integrating the various modules. You can copy between the different modules without a hitch—just open two windows and you can copy a block of data from one to another and do a block move. When you copy data between the spreadsheet and the database, *Works* automatically puts the data into the proper format, rows and columns effortlessly becoming records and fields (and vice versa).

On the assumption that users in an office environment will want to exchange their spreadsheet data, *Works* allows nearly seamless file transfer to and from .WKS and .WK1 files. The only nontranslatable items are macros, string functions, and a handful of formatting commands, logical functions, and at-sign ("@" ) functions.

Transferring files to the *Works* word processor isn't as simple, however, since the package accepts only ASCII files and provides no file conversion.

Particularly interesting is the program's ability to open up to eight files of any type simultaneously. When switching between these windows (not *Microsoft Windows*), *Works* swaps files in and out of RAM with no more than a quick access to disk. If you'd like to see two portions of the same file simultaneously, you can use the product's split-screen feature.

Microsoft has also given all product modules a consistent user interface. To access the command line, you press the Alt key. To make a selection from menus that pull down from the command line, you can then either move the cursor to the desired command or choose the highlighted letter indicating that command. Unlike *Lotus 1-2-3's* type-the-first-letter-and-you're-all-set structure, letter commands in *Works*

are often taken from the middle of a word. For example, you type X, not E, to exit the program.

One annoying aspect of the user interface is that *Works* assumes that all numbers entered are alphanumeric characters unless you precede them with an equals sign. This is just the opposite of the method used by *1-2-3*, in which a number is considered to be part of a mathematical function unless otherwise specified.

To help novice users over the learning curve, *Works* provides both context-sensitive help and an on-disk tutorial, like the one in the original version of *1-2-3*, which teaches you as you use the actual program.

The spreadsheet offers many of the functions of *1-2-3*. It has numerous math, logical, date/time, and financial functions, and macros. It also does eight graph types—including bar, line, stacked bar, pie, area, and high-low close—that you use to graph data from within the work-

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## ■ LOW-END SPREADSHEETS

sheet. The graphics features give you good control over colors, scale, and legends.

Though *Microsoft Works* is not a program that would make anyone who already owns *1-2-3*, *WordPerfect*, and a database program rush out and buy it as a replacement, it is truly a fine group of productivity tools and may be all many people will ever need.—William H. Stewart

### PC-Calc

The current version of *PC-Calc*, a shareware package available for a \$59.95 registration fee from ButtonWare, incorporates a number of features, including macros, spreadsheet customizability, and detailed documentation, that make it attractive for users with moderate spreadsheet needs who don't need *Lotus 1-2-3* compatibility.

You can integrate your *PC-Calc* files with ButtonWare's *PC-File* database program. The common key assignments and relative consistency of commands between the two packages make it easy for users to move between them. The packages also have true integration capabilities; *PC-Calc* and *PC-File* data can be exchanged simply by selecting a menu command.

Installing *PC-Calc* requires nothing more strenuous than copying the files to disk. You can customize your spreadsheets to display all of the CGA screen colors, to show numbers in scientific formats or as negatives, and to sort uppercase letters before lowercase ones.

You call up *PC-Calc*'s main menu by hitting the Slash key, then you choose one of the 16 commands displayed at the bottom of the screen by selecting its first letter. The amount of memory you have left in your worksheet is also displayed on the top command line. The bottom line of the screen tells you your current cell location; it displays a flashing cursor prompt and an arrow that designates the direction of your next move. The package identifies cells with the standard *1-2-3* row/column designation.

*PC-Calc* does provide you with a significant number of functions, including several financial ones such as rate, principal, payment, and periods and statistical ones such as the standard deviations, minimum and maximum. It also offers square roots and rounding.

**MACRO ABILITY** *PC-Calc* allows you to store up to 25 macros. Either you can define them by typing in the keystrokes to set up the macro and choosing a key to represent it, or you can tinker around with them by using the spreadsheet's Translate command, which converts a character code specified by its ASCII number into some other string of characters.

Toggleing on *PC-Calc*'s "smart-cursor" function speeds data entry by continuing cursor movement in a single direction when you press Enter. *PC-Calc*'s Replicate function, used for copying a range of cells, is somewhat less handy. You cannot copy one cell to a block of rows and columns in one step. You must first copy the cell to one row or column and then copy that row or column to the block. If cells in the copied range have formula references to other cells, you are asked to specify if the formulas are "relative or absolute?" for each one. You haven't experienced true frustration until you've copied 20 lines and have had to answer yes or no to as many "absolute or relative?" inquiries.

Although you need to purchase *PC-File* to add true database functions to your *PC-Calc* files, the program includes a nicely implemented Lookup function that allows you to find specific data points in multicolumn tables.

*PC-Calc*'s graphics abilities are limited to frequency plots. While the program uses

asterisks, right square brackets, and slashes to compose these graphs, you can substitute the high ASCII graphics character set for the program's defaults.

Data exchange is another weak spot for *PC-Calc*, as it is with many of the other packages reviewed here. Although the program directly imports ASCII and .DIF files, it neither imports nor exports *1-2-3* files—you'd have to convert *1-2-3* files to .DIF and import them into *PC-Calc*. *PC-Calc* does not require its functions to be preceded with the @ sign, but it is intelligent enough to recognize *1-2-3* functions by ignoring that initial character.


The *PC-Calc* manual is thorough; it assumes you'd like to know how the package works, not just what it can do. In keeping with that philosophy, the manual presents a detailed picture of useful information, such as how to read a *PC-Calc* file from BASIC, and even includes a sample subroutine. The program also displays interesting on-screen information—for example, it will tell you what row it is on when performing recalculations.


*PC-Calc Plus*, in beta-testing at the time of this review, will offer a raft of new features, including graphics, extensive help, a new menu interface, DOS access, sideways printing, and more (although it still won't offer *1-2-3* compatibility). If your spreadsheet needs are modest, you'll probably be comfortable with the present version of *PC-Calc*, but you'll get a lot more for your money if you wait for the next release.—Merv Adrian

### PeachText 5000

Peachtree Software's *PeachCalc* electronic spreadsheet may have been a good product in its time, but it hasn't aged very well. The four-year-old spreadsheet is one component of the *PeachText 5000* integrated package, which also includes a word processor, a thesaurus, a spelling checker, and a list manager. Though it offers a reasonably good help facility and adequate documentation, it would need a major upgrade to bring it in step with the times.

One of *PeachText 5000*'s major flaws is the absence of real integration. You cannot access the program's other applications from the spreadsheet's main menu, and the only way to send spreadsheet files

**FACT FILE**



**PC-Calc**, Version 3.0  
ButtonWare Inc.  
P.O. Box 5786  
Bellevue, WA 98006  
(206) 454-0479  
**List Price:** Shareware:  
\$59.95 registration fee.  
**Requires:** 256K RAM,  
two disk drives, DOS 2.0 or later.

**In Short:** A shareware package that includes macros, is customizable, and contains good documentation. You can integrate the package with the *PC-File* database program. Not copy protected.

CIRCLE 656 ON READER SERVICE CARD





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—Elizabeth Joan Doyle, Indiana

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D. Sorenson, Texas, California

"Easy to install, use, and most importantly, it works!"  
—Dan Nielsen, General Electric, Information Systems, NY

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#6



## ■ LOW-END SPREADSHEETS

to other applications is by sending them to disk as text files. You'll also be disappointed by the lack of a similar command structure among the various modules that would make switching between operations easier.

PeachCalc, like the other modules, is old-fashioned. For instance, PeachCalc's screen display is antiquated; it resembles the original *VisiCalc*. PeachCalc shares with that product the single-letter menu options arrayed across the bottom of the screen. While help screens are always close by, this interface is a far cry from the clearly defined *1-2-3*-style moving-bar menu. Luckily, PeachCalc's help function is more than adequate. Help instructions are written in plain English and are relatively detailed. You reach the help option with the Question Mark key—one of the few intelligent variations from the industry-standard F1 key I've seen.

A nice feature of the interface is a message on the command line that lets you know that work is in progress. This is an improvement over the annoying flashing Wait indicator in the upper-right-hand corner that so many products copy from *Lotus 1-2-3*, if only because your eye focuses on the command line anyway. The status line display indicating the direction the cursor will move after data is entered is also nice. Less attractive is the fact that simply moving the cursor will not allow you to enter data as it will in *1-2-3*; instead, you must

press Enter. Changing direction is something of a hassle with this feature, as well; you'll need at least two extra key-strokes—once to enter and once to move where you want to go.

Unfortunately, PeachCalc lacks many of the features that have become standard with today's spreadsheet programs. The package does offer functions such as addition, subtraction, multiplication, division, net present value, and even trigonometric functions such as sin, cos, SQR. But it lacks other functions that are common in financial calculations, including internal rate of return, future value, and amortization. Frequency plots are the only graphics capabilities available. There also are no import or export functions for *1-2-3*, *dBase*, or other formats.

Installing PeachCalc is not especially difficult, but the documentation seems to have been written before such things as hard disks and subdirectories existed. The manual clearly expects a floppy-disk-based system includes only partial instructions for installing it with a hard disk, it makes no suggestions as to how to set up subdirectories. The program directly supports over 20 popular printer models, and more are being added. But if your printer isn't on that list, you'll need to select the draft interface that won't give you any extras such as underlining or boldfacing.

Many of the product's functions are hopelessly run-down, although the Help feature stands out as a model of common sense, and the documentation is clear and concise if a bit outdated. A serious upgrade built on solid basics is needed to spruce up this elderly spreadsheet. —Merv Adrian

The craftsmanship that went into designing *PFS:First Choice* is evident from the moment you start working with the program. Although you cannot work in multiple applications simultaneously, the simple, elegant, and consistent screen design and command hierarchy make it easy to move between programs.

You access the spreadsheet function from a nine-selection main menu. From this menu, you can also select any other application, exit the program, or choose to see an existing file, in which case an orderly listing of files catalogued by application appears on-screen. Next, a function-key-driven command line with six choices appears across the top of the screen. The consistency of design is apparent in the hierarchy of commands. Since these pull-down menus are nearly identical for all applications, you can quickly become familiar with the range of commands. For example, under Edit, your first option in any application is always Select—be it a block of text, range of numbers, record, or anything else. A series of Alt keys allows you to bypass these pop-up menus.

The spreadsheet program offers a variety of features that are easier to use than those found in some of the "power" spreadsheets, like *Lotus 1-2-3* and its clones. One of the most obvious ease-of-



### FACT FILE



**PeachText 5000,  
Version 2.12**  
Peachtree Software  
4355 Shuckelord Rd.  
Norcross, GA 30083  
(800) 247-3224 (outside  
Ga.)  
(404) 564-5800

List Price: \$199

Requires: 128K RAM, one disk drive, DOS 2.0 or later.

**In Short:** An integrated package that lacks any real integration between the modules. The spreadsheet's commands are single letters, like those of the original *VisiCalc*, and the program offers few features. Not copy protected.

CIRCLE 655 ON READER SERVICE CARD



### FACT FILE



**PFS:First Choice,  
Version 2.0**  
Software Publishing  
Corp.  
P.O. Box 7210  
1901 Landings Dr  
Mountain View, CA  
94039-7210

(415) 962-8910

List Price: \$149

Requires: 512K RAM, one disk drive (hard disk recommended), DOS 2.0 or later.

**In Short:** An integrated package with a spreadsheet, database, word processor, report generator, spelling checker, and graphics. While the spreadsheet lacks some of the power features found in larger spreadsheets, such as date and time functions, it offers such ease-of-use features as columns that automatically widen to accommodate headings. Not copy protected.

CIRCLE 656 ON READER SERVICE CARD





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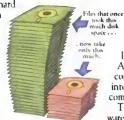
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Cubit has always performed superbly with all kinds of data—particularly text files and databases.

But now, Cubit is the most effective software you can buy for compressing your Lotus worksheets. In fact, new Cubit gives you an average of 70% compression for both 1-2-3 and Symphony files. And remember, we said average compression, which takes into account all your Cubit-compressed worksheets.

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Cubit not only works better than the other compression software, it works faster. For example, Cubit decompresses files in 1-2-3 twice as fast as the other program. So your spreadsheet is up on screen in half the time.

That same "other" program re-compresses 1-2-3 files each time you save them. Cubit waits until you exit 1-2-3, and then automatically re-compresses all the compressed files that were used during that session. Imagine the time you'll save.

Plus, only Cubit includes UnCubit, a special decompress-only program you can distribute freely, so you can share your Cubit-compressed files. It's ideal for team projects. And great for saving line charges on tele-communicated files. Just send UnCubit along with your transmission. So why buy a bigger drive, when you can have smaller files?

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"1-2-3 users will love it..."

—David Trevis, PC World, October 1987

"Saved me \$700 for a new disk drive."

—David Silver, Tivo Services, Thornhill, Ontario

"I gained almost 4MB of storage."

—Dennis Garneau, Impact Management, Inc., Branson, MO

"Well conceived product, good documentation, good price, works well—I am indebted!"

—Tom Mayhew, Cogent Data Services, Inc., Lubbock, GA

"It's an excellent utility. We've compressed our files 40-50%!!"

—Edward Mrs. Hamana Medfirst, Bridgman, MO

**Cubit \$69<sup>95</sup>**

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## ■ LOW-END SPREADSHEETS

use features is the automatic column-width adjustment for spreadsheet labels (called headings), which are entered across the top row and down the left column of the worksheet. Type a heading, and the spreadsheet automatically widens to accommodate it. Enter lengthy data in a cell, and watch the column widen. You can even specify a minimum width. If you begin a cell entry with an alpha character, the entry can cross over column boundaries without widening the column. These features give you the freedom to enter data, create headings, and write comments without your giving a hoot about cell width.

You do most of the real spreadsheet work within pop-up boxes. You can create a formula using the pop-up formula box that contains entries for a named cell and the formula. Editing the formula is facilitated by a full set of cursor movement commands. Cell styles (both individual and global) are also assigned with a neat, albeit limited, pop-up menu. You can choose currency symbols, comma placement, show a percentage, or indicate decimal placement by answering the prompt lines accordingly. You enter formulas using a fairly complete set of functions and operators.

As with many other low-cost packages, the date and time functions are absent, as is the ability to create a named range. However, the program does recognize normal mathematical hierarchy and allows as many as 15 pairs of nested parentheses.

**QUICK ENTRY FUNCTION** One of the special highlights of the program is the Quick Entry function. This brainy feature lets you duplicate heading, value, or formula entries across rows or down columns with a single keystroke. It also recognizes incremental headings. For example, if you type January as a column heading, it inserts the names of the succeeding months in the other column headings as you press the Tab key. (1-2-3 lets you do that too—if you buy the \$150 HAL add-on).

The bookmark facility, as its name implies, lets you mark your place in the spreadsheet, do something else, and then return to where you left off. This is an infinitely more useful feature than GOTO, although *First Choice* offers a GOTO function as well. It's much easier to leave an

application and ask the program to search for the bookmark than it is to remember which cell you had been working in. You can set up to nine bookmarks at once, which makes it easy to jump around the spreadsheet and edit formulas or move from application to application. There is also a handy calculator feature that lets you enter one-line calculations and places the results automatically in a cell. And the well-executed graphics integrate beautifully with the spreadsheet, so you can simply point to cell ranges and include the data in a graph.

Despite these nifty features, *PFS:First Choice* users may still require some upward compatibility. The latest version of the program allows import and export of 1-2-3 (.WKS files) and *PFS:Plan* data. The import and export for 1-2-3 works well; I had no problem importing even PC Labs' largest performance test files. However, inconsistencies arose when I used *First Choice*'s wide columns. I had to go in and tidy up labels and headings.

Any complaints? A few. I would prefer an alphanumeric cell name such as 1-2-3's A1 designation over *PFS:First Choice*'s current, four-character RIC1 notation. Writing long formulas with row-and-column notation is tedious and confusing. Of course, dropping down to DOS, windowing, and macros would be nice, too.

The addition of these features could only make what is already a top-of-the-line product even better. The current version of *PFS:First Choice* has evolved into a serious office productivity tool. It has successfully managed to define that delicate balance between a simple and functional design and powerful features.

—Robin Raskin

## Spreadsheet for the IBM PC, XT, and AT

Scandinavian PC Systems' *Spreadsheet for the IBM PC, XT, and AT*, Version 1.0, is distinguished by an excessively long name, its foreign origins, and little else. The package's slow speed, unfriendly user interface, and lack of adequate technical support are suited only for users who plan to create nothing more strenuous than the most simple spreadsheets and can get by without immediate outside help.

Priced at \$49.95, *Spreadsheet* can be loosely integrated with the company's *Word Processor for the IBM PC, XT, and AT* (\$49.95); *Database for the IBM PC, XT, and AT* (\$49.95); and *Readability* (\$59.95), an analysis program. Like most of the product's other features, its integration abilities are minimal. You can print your spreadsheet files to disk as text files and import them into the other programs, but this method is inferior to those employed by true integrated packages and even modular systems.

Once you load the program, you are presented with a screen that shows 20 rows and 8 columns of the 100-row, 26-column spreadsheet. The status line at the top of the screen shows the name of the spreadsheet and the percentage of memory remaining. The status line also displays the recalculation method. The default is the automatic recalculation method, which makes spreadsheet use slow (this package is nearly eight times slower than *Lotus 1-2-3*), but the manual method is quite clumsy to use.

*Spreadsheet*'s menu program helps you create, edit, print, and manage your spreadsheets. You can add and delete rows and columns, move and copy blocks of cells, format cells, and print the spreadsheet. While these are all the basics that you need to create functional spreadsheets, they're implemented rather strangely. For instance, to copy a cell, you must indicate the number of cells to be copied by block-



## FACT FILE



*Spreadsheet for the IBM PC, XT, and AT*, Version 1.0  
Scandinavian PC Systems  
3 Brookside Park  
Old Greenwich, CT  
06780

(203) 698-0823

List Price: \$49.95

Requires: 256K RAM, one disk drive, DOS 2.0 or later.

**In Short:** A clumsy spreadsheet with average features and slow performance. Not copy protected.

CIRCLE #62 ON READER SERVICE CARD





## When you need to move quickly among programs and files, Software Carousel™ carries the load for you.

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—Ralph Evans, Attorney, Fullerton, CA

"Unlike other attempts (e.g. MS Windows, DesqView) yours works, is not fragile and does not intrude its 'personality' on everything that we do."  
—Colin Ralph, Ralph & Pinner, Inc., Seattle, WA

"Fantastic program. Great book. Saves me an hour a day! Thanks."  
—Larry Purnell, Rolling Hills Covenant Church, Rolling Hills Estates, CA

"Solved all my problems with resident software."  
—Walter Ajfornia, West Islip, NY

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#6



## ■ LOW-END SPREADSHEETS

ing them off with the Start Block and End Block commands. Then put the cursor where you want the cell to move. The program then asks how many lines you would like to copy the cells to. This is far more convoluted than 1-2-3's clearly implemented /Copy from, to, copy command.

You select the menu commands by choosing their corresponding function keys. To leave the menu, you press the Esc key. The function keys are independent of cursor movement, so you can change your cursor position even if you are two or more levels deep into the menu. This can cause problems. If you leave the menu (intending to return shortly) without pressing the Esc key and go back to working in the spreadsheet, the odds are good that you'll forget you've already moved one or more levels down in the menu. Then if you press a function key that is appropriate to a level 1 command, it will be totally inappropriate to the level you have reached, resulting in accidentally deleted columns, displaced cells, and much more.

Along with text, values, and formulas, *Spreadsheet* offers 66 functions, such as @If, @Lookup, and @Sum. You can use the F8 key to jump to a specific cell, and the cursor keys, PgUp, PgDn, and Tab help you navigate the spreadsheet in the traditional way. But three successive uses of the Home key will move you first to the left of the screen, then to column A, and finally to A1. This is a waste of time: Home should take you directly home; you shouldn't have to go visiting first. *Spreadsheet* also has a simple macro capability that you can use to link cells in your current spreadsheet to those in another.

**SLOW CALCULATIONS** The package is painfully slow in calculating even a moderate amount of large formulas in the spreadsheet. Deleting a single column brought the AT used for PC Labs testing to its knees. The time it took to calculate our test file was more than seven times slower than 1-2-3, Release 2.01. Test results for saving to and loading from disk were, respectively, 1½, and 2½ times slower than those of 1-2-3. And since the package doesn't use all of the memory available, we were unable to perform some of the PC Labs performance tests.

The manual is written for the novice

user. It does a good job of leading you step-by-step through the installation and use of *Spreadsheet*, as well as explaining general spreadsheet theory. It is full of examples and contains a well-referenced table of contents and index. You'll note, however, that some unusual terms, such as *fetch* instead of *load*, pop up at times, possibly because of the translation from Swedish to English. The author also placed a cartoon on the last page of each chapter that ends on the right side, detracting from an otherwise professional manual. Technical support is rather different; the company and its support team are based in Sweden, so you must call the American representative, who in turn forwards your question to Sweden. The company promises a 24-hour response.

You install *Spreadsheet* by executing a batch file that transfers the package to your floppy or hard disk. Installing the software automatically creates a subdirectory called SPCSSPR (for Scandinavian PC Systems' *Spreadsheet*). That's not an easy name to remember when you're trying to change directories. Printer installation is fairly routine. Although *Spreadsheet* assumes that you have an IBM Graphics Printer, you can set up your own printer and print codes with an installation program.

The company has, however, come out with a new version, which was unavailable at the time of this review. It will offer many new features, including added search features; 30 new mathematical, statistical, and logical functions; integral calculation; and more.

But as the product stands now, most users will find *Spreadsheet* for the IBM PC, XT, and AT too slow, too clunky, and too unsophisticated to meet their needs. And it doesn't help that to get technical support, you've got to go through an interpreter and be willing (and able) to wait until the next day. With the abundance of good 1-2-3 clones and shareware spreadsheets on the market today, it should be easy to find a package that performs better than *Spreadsheet*. —Mike Falkner

## THE Spreadsheet

Despite its definitive-sounding name, *The Spreadsheet*, from Indian Ridge Enterprises, is not the spreadsheet to end all

spreadsheets. The \$49.95 program is a simple, comfortable package for the novice user—with lots of help features and menu commands written in plain English. However, the program lacks many of the functions that these users will eventually require.

*The Spreadsheet's* bevy of help and tutorial options include a trio of context-sensitive help messages, on-screen mini-manuals, and hands-on tutorials. The extensive context-sensitive help messages can occupy the lower half of the display screen or be toggled off and on with a single command. If you do leave them on, the screen is automatically (and annoyingly) redrawn after every cursor movement.

Pressing the Question Mark key calls up a full-screen explanation that serves as an electronic minimanual. This explanation mostly mimics the printed documentation, which itself is sparse. The on-line tutor offers a 20-lesson instructional session: 10 of the lessons summarize spreadsheet basics, such as moving around the worksheet and performing math functions, the other 10 lessons are how-to practices, which consist of examples on how to enter data into the spreadsheet. You can enter these practice commands, which are detailed on the lower half of the screen, into a live spreadsheet. The examples are well thought out, and the practice categories are well chosen. But because the spreadsheet window and practice instructions are not



## FACT FILE



**THE Spreadsheet,**  
Version 1.0  
Indian Ridge  
Enterprises Inc.  
508 Second St.  
Oakland, CA 94607  
(415) 268-1631

List Price: \$49.95

Requires: (28K RAM, one disk drive, DOS 2.0 or later.

**In Short:** *The Spreadsheet* is the spreadsheet component of an extensive modular environment. Tutorials and practice sessions are available, but the spreadsheet is cumbersome and clumsy for anything but the simplest tasks. Not copy protected.

CIRCLE 881 ON READER SERVICE CARD



linked, there is no feedback about incorrectly entered information.

Once you learn the program, you'll find that *THE Spreadsheet* has a number of blemishes. One irritating, if not fatal, flaw is its screen design. ASCII characters are used to create some exceedingly amateurish screen displays. Ugly // (slashes) indicate that the current cell is blank. The program does not even take advantage of color or graphics capabilities.

Installation and print functions, each a traditional nemesis for new users, are handled without user intervention, but in a rudimentary fashion. The automatic installation program also appears to be buggy. The spreadsheet recognized drive C: when I installed the program in my hard disk subdirectory. I was able to use the Disk-Choose command to reassign the disk as drive A: and successfully read files on my floppy disk. However, when I tried to return to the hard disk drive by again selecting Disk-Choose, the program informed me that drive C: was not enabled by the .EXE file. I could not recognize my C: drive again without rebooting the program. While the automatic printer installation works well, you can send only straight ASCII codes to the printer.

A single-line menu with 11 commands in plain English is located at the top of the spreadsheet. Typing the first letter of a command calls up its submenu. For example, the Array command allows you to Copy, Replicate, Move, Insert, Delete, or Blank. However, submenu commands such as Copy and Replicate not only are confusingly similar concepts, but they also all have restrictions about the types of data groups they can work with. The Replicate command, for instance, applies only to cells and ranges of cells, while the Copy command can be used with these as well as with blocks of cells. If you should manage to confuse the two, you won't get much help in ending your dilemma from the program's paltry 16 error messages. Messages like "Value or formula error! Edit and enter again or ESC to escape" only tell you you're doing something wrong; they don't offer any useful advice on how to make it right. You might fare better by bypassing the menus altogether and using the Backslash commands, which function as this program's speed keys.

## PC EDITOR'S CHOICE

- InstaCalc
- Microsoft Works
- QubeCalc

*Among standalone small spreadsheets, FormalSoft's InstaCalc and QubeCalc are big, feature-filled fish in a small pond. These products are nearly identical, having the same user interface and core of features. The only difference is that InstaCalc is a two-dimensional RAM-resident spreadsheet, while QubeCalc offers three-dimensionality. The packages are shareware, with registration fees of \$49.95 and \$69.95, respectively. The core package for both is extremely impressive, including such features as trigonometric functions, statistical commands, and financial functions. The package's logical, date, time, and string functions are rare in packages as small as these. These programs also offer import and export of .DIF and Lotus .WKS file formats, as well as rudimentary graphics—all areas that trip up the competition.*

*If you prefer an integrated package, Microsoft Works, a new entry in the market for small business tools, combines a relatively powerful spreadsheet with word processing, database, and communications capabilities into a \$195 package. Its spreadsheet offers most of the features anyone would want in a spreadsheet, including good import and export of 1-2-3 files, flexible graphics, and macro capabilities.*

*Honorable mention goes to Software Publishing's PFS:First Choice, which is also a fine, nicely integrated and implemented product. It was narrowly beaten by Microsoft Works because that product offers macro capabilities and because it allows you to open up to eight windows simultaneously and easily copy data between them.*

**EDITING PROBLEMS** You'll encounter even more problems when you try to edit a formula with *THE Spreadsheet*. There is no insert mode. If you want to insert characters into a formula you'll have to retype the entire formula. If you want to enter a label, you must precede it with the letter L—an eccentricity I found that I often forgot.

If you keep to simple linear formulas, you won't have too much trouble using *THE Spreadsheet*. It makes good use of split-screen windows and contains a sizable set of built-in financial, logical, and mathematical functions. However, the program is simply incapable of matrix math. You can work calculations on a row-by-row or column-by-column basis, but the program will not allow you to perform any operations on a range of data. This made running the PC Labs performance tests an impossibility. (We could have calculated the performance tests by working on a row-by-row and column-by-column basis to achieve the identical end result, but our spreadsheet would have become considerably larger than the performance-tested spreadsheet.)

Besides its inability to perform operations on a range of data, the program is missing many other functions that users will discover that they need as they become more sophisticated about spreadsheets. It has only the most rudimentary graphics capabilities, which use an asterisk (\*) to plot frequencies. The package does not use a logical recalc order—each time one cell in the spreadsheet changes, it automatically goes back and recalculates every cell from left to right, whether they've changed or not. It will also list only one file at a time. For 30 minutes I puzzled over where my files were until I accidentally hit the Enter key and was scrolled to the next file listing.

The user who wants to tailor his own personal productivity solution may appreciate having the ability to integrate *THE Spreadsheet* with Indian Ridge's accounting, word processing, and multiuser-environment modules (available at extra cost). But users who will someday want to perform matrix math operations and other sophisticated functions will find *THE Spreadsheet* inadequate for their needs.

—Robin Raskin



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■ PC LAB NOTES: LASER PRINTERS ■ CAROLINE HALLIDAY

# LEARNING TO LIVE WITH LASER PRINTERS, PART 1

*If you think that laser printers are only glorified daisy wheels or that they're impossible to understand, this two-part article should change your mind.*

Speed, printlike quality, and quiet are the things you miss most if your laser printer goes down and you have to dust off and reinstate the old daisy wheel or dot matrix temporarily. The feeling is a little like going back to a floppy disk drive PC after getting used to an AT with a fast hard disk. True, you can do the work, but it's such a drag it just doesn't seem worth doing.

For a beginner, though, making a laser printer perform its magic is not always easy. The requirements for getting started are a long weekend and a ream of copier paper. True, most of today's full-featured word processors, spreadsheets, and database programs can drive the more popular laser printers right out of the box. Still, you'll inevitably find that there are niggling little additions or changes you just feel you have to make to get things right. The pages of *PC Magazine's* Productivity section have always been full of hints on making printers do what you want them to do. The difference is only that laser printers represent a quantum leap forward in their capabilities and, consequently, in their complexity.

**THE HP STANDARD** As with their dot matrix and daisy wheel counterparts, laser printers' output is regulated by the various control codes that are sent to them. A specific string of characters, usually beginning with the Escape character (ASCII 27), is sent from the computer. The printer interprets this string not as a set of characters to be printed, but as a command to change its mode of operation: to begin

printing in boldface, for example, or to change the number of lines per inch.

Traditionally, printer manufacturers seem to have based their choices for which codes would control which printer func-

## PRODUCTIVITY INDEX

### PC LAB NOTES

A guide to plotting out your laser printer's escape sequences.

### UTILITIES

RUN.COM runs programs no matter where they try to hide on your disk.

### ENVIRONMENTS

How the OS/2 Kernel faces up to keyboard input and standard input.

### POWER PROGRAMMING

C and MASM functions that chomp ASCII strings of numbers into bits.

### SPREADSHEET CLINIC

Menus with informative prompts; attaching add-in *Symphony* apps.

### USER-TO-USER

Flexible ERRORLEVEL setter; DOS calculator; new PATHs in a hurry.

### POWER USER

Moving light-bar menu for dBASE; WordPerfect printing while you work.

### LANGUAGES

Turbo Pascal error handler that names routines; a C backup tracker.

### PC TUTOR

Dialing phones and dumping screens in C; temp files with weird names.

### CONNECTIVITY CLINIC

More space from *NetWare* hard disks; long-distance StarLAN wiring.

tions on such considerations as the phase of the moon, the previous day's winning numbers, and the laundry marks on their shirts. Fortunately, there are now discernible signs of an attempt to bring order into the resulting chaos. New laser printers often provide a "Diablo emulation mode," for example, that allows software written for the venerable Diablo 630 daisy wheel to run on them (limited, of course, to the kinds of printing the Diablo could do). Similarly, many printers are now "Epson compatible," not because the FX-85 was ever the be-all and end-all of dot matrix printers, but because so much software was written to run on it.

The Hewlett-Packard LaserJet and its HP successors have enjoyed such market dominance that most laser printer manufacturers have had to swallow their pride and provide an "HP emulation mode." The original LaserJet is limited to text output, though many different fonts can be used and text can be made bold or underlined by using HP's Programming Control Language (PCL). The newer LaserJet Plus introduced graphics capabilities and extended the scope of PCL. The same Programming Control Language is used in the new HP LaserJet series II, whose moderate street price (well under \$2,000), smaller size, and more advanced Canon printing engine have quickly made it the most popular of the three and an obvious Editor's Choice in our recent printer survey issue (November 10, 1987). Thus, HP's PCL has become a de facto standard for today's laser printers.

In Part I of this article I'll cover such



## ■ PC LAB NOTES

PCL topics as underlining or boldfacing text, printing multiple copies, selecting among the alternative fonts that are built into the printer, putting lines around text or between columns, providing fancy boxes or borders, and making a simple logo. Part 2, in our next issue, will take up more-advanced topics, such as handling downloaded fonts and producing more-complex graphics. After reading the two, you'll have sufficient understanding to put that long weekend to good use.

**GENERAL METHOD** Printers only change their current mode of operation when they receive a suitable control sequence of characters. Any word processor that allows the Escape code to be entered and will save files in an ASCII format can be used to make a file containing the PCL control codes needed by the HP (and compatibles). If you prefer, of course, printer modes can be changed using a programming language such as BASIC or C. Or, to do the job with the ultimate ease and elegance, you can use the programming utility that will be presented in next issue's Utilities column.

The text files needed to issue printer commands are only a few bytes long. Entering the Escape code with a word processor or text editor usually requires pressing the Alt key and typing the decimal value 027 on the numeric keypad. The screen will display the symbol that the particular text editor uses to represent the Escape character. [In XyWrite you hit the Esc key itself. Entering Alt-Shift-027 on the keypad displays the conventional left-pointing arrow, not XyWrite's Escape character.—Ed.] You then enter the other characters that are needed and save the file.

When the mode of the printer needs changing, then, the file can be copied to the printer. For example, to copy the file TEST to a laser printer connected to LPT1:, the following command should be entered at the DOS prompt:

### COPY TEST LPT1:

If you would like to send more than one file at once to the printer, the files can be combined and copied in one step. For example, to set the printer in a new mode and then to send a text file to be printed, the copy command can be used twice, or the

## Sample Portrait Page

The portrait page shown here is created by the codes and text contained in the listing that follows this illustration. It covers many of the positioning and graphics techniques discussed in the article. All the text uses the LaserJet II's built-in fonts and symbol sets. To print this illustration (and the similar "Sample Landscape Page"), you should use your word processor to enter the accompanying codes, observing the precautions explained in their captions. You can then use

### COPY PORTPAGE LPT1

(or whatever filename you give it) to print out the illustration.

The first Escape sequence after the initial reset command should be the orientation command, which forces the printer into the portrait mode. The cursor is then positioned using absolute coordinates (the units are in dots), and the underline command is turned on. The title is sent to the printer and the underline command is turned off. Note that there is no CR-LF between the cursor position and the title, and the underline is turned off before the CR-LF.

Next the cursor is moved to the left-hand margin and the second row, the underline command is turned on, and the title "Standard Fonts available on LaserJet Plus and LaserJet series II" is followed by the end underline command. Three CR-LFs are then sent, moving the cursor position to the left margin on the fifth row.

Symbol set 8U is the HP Roman-8 set, and it is selected along with the Courier 10-pitch 12-point font. The next line uses the same symbol set but switches to the bold font by changing the 0b in the Escape sequence to 3b. The following line selects the line printer compressed 16.6-pitch 8.5-point font and then reselects the Courier font.

The cursor is moved to the left margin and the ninth row using absolute coordinates and the bold command is sent. The next line of code moves the cursor to the next row and turns the underline mode on. The bold command is turned off at the end of the line, and the next line is printed with just the underline. The underline is then turned off and a normal line of text is printed.

The next two lines of Escape sequences demonstrate the effect of using the printer's two different underline modes with the default fonts. You'll note that the floating underline is one row lower than the fixed underline for the two fonts shown; a better demonstration would require a larger difference in font sizes. This will be shown in more detail in the next issue's installment.

The title for the next section is printed on row 19. The underline mode is again turned on at the beginning of the line and turned off at the end. The description and headings for

the pattern test are printed in the line printer font and then the Courier font is reselected. The heading "Ranges" has the underline mode turned on. The Escape sequences cause the printer to produce 100 rectangles that are 22 dots wide and 100 dots deep, printed across the page at 24-dot intervals. The cursor position for each of the rectangles is obtained by moving the cursor using absolute coordinates. Each successive rectangle has a different gray-scale setting in the Escape sequence. The gray scale that is actually printed for a given percentage is one of eight predefined levels.

The next test prints three columns on the page and draws a line between the first two columns. The title is printed by moving the cursor to row 36 and turning the underline on, sending the title, and then turning the underline off. The first column of text is printed by moving the cursor to the left margin on row 38 and sending CR-LF after each line.

The second column of text is sent by first resetting the left margin of the page to column 18; the cursor is then moved to the new left margin of row 38 by using a relative coordinate for the column position. (An absolute coordinate position would cause the cursor to be moved outside the current page setting to the limit of the page.) The CR-LF at the end of each line of text in the second column moves the cursor to the current left margin on the next row.

The third column of text is printed by moving the cursor using absolute coordinates in front of each line of text. The line between the first two columns is drawn using the rule command, and the cursor is moved using dot coordinates so that the line starts at the top of the character position and not at the base of the character.

The next two tests on the portrait page demonstrate how to draw boxes around text, using the two different methods discussed in the body of the article. The first method changes the symbol set to the IBM PC-8 so that the line-draw characters are available. The box is drawn with a line of text within the shape.

The second method uses the printer's rule commands. The cursor is placed using absolute coordinates, and then each of the lines in the box is drawn in turn. If a box required looks exactly the same as that produced by the extended character set, then the character set is a more efficient method as far as design and creation time is concerned, but the rules method obviously is far more versatile.

The final command for the portrait page is the reset command. This causes the page to eject and the printer to be reset to its default configuration.



PC MAGAZINE SAMPLE LASER PRINTER PORTRAIT PAGEStandard Fonts available on LaserJet Plus and LaserJet series II

This is a sample of the Courier 10 pitch 12 point portrait font.  
 This is a sample of the Courier bold 10 pitch 12 point portrait font.  
 This is a sample of the Line Printer Compressed 16.6 pitch 8.5 point portrait font.

This is a sample of bold type.  
This is a sample of type that is bold and underlined.  
This is a sample of type that is underlined.  
 This is a sample of type that is not bold or underlined.

This row has fixed underlining in two different styles.  
This row has floating underlining in two different styles.

Standard Patterns built into LaserJet + and series IIStandard Gray Scales built into LaserJet + and series II

Each of the one hundred rectangles is a different percentage of gray scale. Eight predefined levels are available.

Column Test

This test puts three columns of text side by side. The second column of text is printed by moving the left margin setting. The third column is produced by indenting each line of text that is in the column.

The vertical line is generated using the rule command.

This box is produced by changing fonts and using the extended character set.

This box is produced by using the built in LaserJet Plus Rules.



## ■ PC LAB NOTES

plus sign can be placed between the file-names. Thus, if the file to make the printer print in bold is called BOLD, the file to eject the page is called EJECT, and the text file is DATA, the command to print the DATA file in bold and then eject the page would be

COPY BOLD+DATA+EJECT LPT1;

[Note that the **BOLD** instruction in this example will be applied to the whole DAT file. Next issue's Unifiles column will present a program you can use to turn any printer instructions (including those not supported by your word processor) on and off at any point in a file. Users of XyWrite III Plus can do this already by using the **PI** (Printer instruction) command.—Ed.]

**PCL IN ACTION** Normal letters and memos are printed so that the printing goes from left to right across the short dimension of the paper, as in a painted portrait (see the illustration "Sample Portrait Page"). With a single command sequence, however, you can change the output so that the printing stretches from left to right across the long dimension of the paper, as in a landscape painting (see "Sample Landscape Page"). The command sequence to change from portrait (the default mode) to landscape printing is

## Esc&amp;l10

To change back to portrait mode you use

## Esc4100

On the LaserJet Series II, up to 99 copies of the same page can be programmed from the computer. To get three copies you'd use the sequence:

## Enc613X

Notice certain similarities among these three commands. All begin with an Escape character, followed by an ampersand (&) and a lowercase "i" (not to be confused with the numeral "1"). All three end with an uppercase letter.

Suppose, now, that you wanted to print three copies of a document in landscape mode. You *could* stick two full escape sequences back-to-back, thus

Esc&110Esc&13X

On the other hand, HP's PCL language lets

- Any mode set with a control code remains in effect until canceled.

Thus the reset command, which returns you to the default setting, is of crucial importance.

you produce the same result by combining the two strings, thus:

## Esc&amp;11o3X

While HP uses an almost Hegelian vocabulary to describe the various components of its "Parameterized Escape Sequences," in practical terms the rules for combining control sequences come down to this:

1. If the first two characters that follow

```

EscEsc4180
Esccp58b258Escd80FC MAGAZINE SAMPLE LASER PRINTER PORTRAIT PAGE&ac60

Esc&ac38Esc&ac38DStandard Fonts available on LaserJet Plus and LaserJet series IIEsc&acD

Esc(EscEsc&sp11h2v8b3J7b1) is a sample of the Courier 18 pitch 12 point portrait font.
Esc(EscEsc&sp11h2v8b3J7b1) is a sample of the Courier bold 18 pitch 12 point portrait font.
Esc(EscEsc&sp16.6h3.5v8b28T7T1) is a sample of the Line Printer compressed 16.6 pitch
      8.5 point portrait font. Esc(EscEsc&sp11h2v8b3J7

Esc&ac&18Esc&ac&38T11) is a sample of bold type.
Esc&ac&11Esc&ac&acD&acD is a sample of type that is bold and underlined. Esc&ac&
Esc&ac&12T11) is a sample of type that is underlined. Esc&acD
Esc&ac&13T11) is a sample of type that is not bold or underlined.

Esc&ac&15Esc&ac&15Esc(Escp16.6h3.5v8b28T&ac&acD&acD) is row has fixed underlining
Esc(EscEsc&sp11h2v8b3J7b1) in two different types.
Esc&ac&16Esc&ac&16Esc(Escp16.6h3.5v8b28T&ac&acD&acD) is row has floating underlining
Esc(EscEsc&sp11h2v8b3J7b1) in two different types. Esc&acD

Esc&ac&19Esc&ac&19Esc&ac&acD&acDStandard Patterns built into LaserJet + and series IIEsc&acD

Esccp58a110871 Esccp358a8 Esccp3358a Esccp3358a Esccp3358a 5 Esccp3358a 6
Escp&ac1125Escp&ac20&ac108b&ac3J&acp&ac425Escp&ac20&ac108b&ac3J&acp&ac425Escp&ac20&ac108b&ac3J
Escp&ac425Escp&ac20&ac108b&ac3J&acp&ac425Escp&ac425Escp&ac108b&ac3J&acp&ac425Escp&ac20&ac108b&ac3J

Esc&ac&27Esc&ac&27Esc&ac&acD&acDStandard Gray Scales built into LaserJet + and series IIEsc&acD

Esc(EscEsc&sp16.6h3.5v8b28T&ac&acD&acD) is a sample of each of the one hundred rectangles is a different percentage of
gray scale. Eight predefined levels are available.
EscD&ac&ac&ac&acD

1-2% 3-10% 11-20% 21-35% 36-55%
4% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65% 70% 75% 80% 85% 90% 95% 100%

Esc(EscEsc&sp11h2v8b3J7b1)

```

## References

*The codes necessary to produce the "Sample Portrait Page." Note that you must substitute the actual escape character for the Esc: shown. All indented lines should be entered as direct continuations of the preceding lines.*



```

Esc*p0x1600YEsc*c22a100b1q2P
Esc*p24x1600YEsc*c22a100b2g2P
Esc*p48x1600YEsc*c22a100b3g2P
Esc*p72x1600YEsc*c22a100b4g2P
Esc*p96x1600YEsc*c22a100b5g2P
Esc*p120x1600YEsc*c22a100b6g2P
Esc*p144x1600YEsc*c22a100b7g2P
Esc*p168x1600YEsc*c22a100b8g2P
Esc*p192x1600YEsc*c22a100b9g2P
Esc*p216x1600YEsc*c22a100b10g2P
Esc*p240x1600YEsc*c22a100b11g2P
Esc*p264x1600YEsc*c22a100b12g2P
Esc*p288x1600YEsc*c22a100b13g2P
Esc*p312x1600YEsc*c22a100b14g2P
Esc*p336x1600YEsc*c22a100b15g2P
Esc*p360x1600YEsc*c22a100b16g2P
Esc*p384x1600YEsc*c22a100b17g2P
Esc*p408x1600YEsc*c22a100b18g2P
Esc*p432x1600YEsc*c22a100b19g2P
Esc*p456x1600YEsc*c22a100b20g2P
Esc*p480x1600YEsc*c22a100b21g2P
Esc*p504x1600YEsc*c22a100b22g2P
Esc*p528x1600YEsc*c22a100b23g2P
Esc*p552x1600YEsc*c22a100b24g2P
Esc*p576x1600YEsc*c22a100b25g2P
Esc*p600x1600YEsc*c22a100b26g2P
Esc*p624x1600YEsc*c22a100b27g2P
Esc*p648x1600YEsc*c22a100b28g2P
Esc*p672x1600YEsc*c22a100b29g2P
Esc*p696x1600YEsc*c22a100b30g2P
Esc*p720x1600YEsc*c22a100b31g2P
Esc*p744x1600YEsc*c22a100b32g2P
Esc*p768x1600YEsc*c22a100b33g2P
Esc*p792x1600YEsc*c22a100b34g2P
Esc*p816x1600YEsc*c22a100b35g2P
Esc*p840x1600YEsc*c22a100b36g2P
Esc*p864x1600YEsc*c22a100b37g2P
Esc*p888x1600YEsc*c22a100b38g2P
Esc*p912x1600YEsc*c22a100b39g2P
Esc*p936x1600YEsc*c22a100b40g2P
Esc*p960x1600YEsc*c22a100b41g2P
Esc*p984x1600YEsc*c22a100b42g2P
Esc*p1008x1600YEsc*c22a100b43g2P
Esc*p1032x1600YEsc*c22a100b44g2P
Esc*p1056x1600YEsc*c22a100b45g2P
Esc*p1080x1600YEsc*c22a100b46g2P
Esc*p1104x1600YEsc*c22a100b47g2P
Esc*p1128x1600YEsc*c22a100b48g2P
Esc*p1152x1600YEsc*c22a100b49g2P
Esc*p1176x1600YEsc*c22a100b50g2P
Esc*p1200x1600YEsc*c22a100b51g2P
Esc*p1224x1600YEsc*c22a100b52g2P
Esc*p1248x1600YEsc*c22a100b53g2P
Esc*p1272x1600YEsc*c22a100b54g2P
Esc*p1296x1600YEsc*c22a100b55g2P
Esc*p1320x1600YEsc*c22a100b56g2P
Esc*p1344x1600YEsc*c22a100b57g2P
Esc*p1368x1600YEsc*c22a100b58g2P

```

```

Esc*p1392x1600YEsc*c22a100b59g2P
Esc*p1416x1600YEsc*c22a100b60g2P
Esc*p1440x1600YEsc*c22a100b61g2P
Esc*p1464x1600YEsc*c22a100b62g2P
Esc*p1488x1600YEsc*c22a100b63g2P
Esc*p1512x1600YEsc*c22a100b64g2P
Esc*p1536x1600YEsc*c22a100b65g2P
Esc*p1560x1600YEsc*c22a100b66g2P
Esc*p1584x1600YEsc*c22a100b67g2P
Esc*p1608x1600YEsc*c22a100b68g2P
Esc*p1632x1600YEsc*c22a100b69g2P
Esc*p1656x1600YEsc*c22a100b70g2P
Esc*p1680x1600YEsc*c22a100b71g2P
Esc*p1704x1600YEsc*c22a100b72g2P
Esc*p1728x1600YEsc*c22a100b73g2P
Esc*p1752x1600YEsc*c22a100b74g2P
Esc*p1776x1600YEsc*c22a100b75g2P
Esc*p1800x1600YEsc*c22a100b76g2P
Esc*p1824x1600YEsc*c22a100b77g2P
Esc*p1848x1600YEsc*c22a100b78g2P
Esc*p1872x1600YEsc*c22a100b79g2P
Esc*p1896x1600YEsc*c22a100b80g2P
Esc*p1920x1600YEsc*c22a100b81g2P
Esc*p1944x1600YEsc*c22a100b82g2P
Esc*p1968x1600YEsc*c22a100b83g2P
Esc*p1992x1600YEsc*c22a100b84g2P
Esc*p2016x1600YEsc*c22a100b85g2P
Esc*p2040x1600YEsc*c22a100b86g2P
Esc*p2064x1600YEsc*c22a100b87g2P
Esc*p2088x1600YEsc*c22a100b88g2P
Esc*p2112x1600YEsc*c22a100b89g2P
Esc*p2136x1600YEsc*c22a100b90g2P
Esc*p2160x1600YEsc*c22a100b91g2P
Esc*p2184x1600YEsc*c22a100b92g2P
Esc*p2208x1600YEsc*c22a100b93g2P
Esc*p2232x1600YEsc*c22a100b94g2P
Esc*p2256x1600YEsc*c22a100b95g2P
Esc*p2280x1600YEsc*c22a100b96g2P
Esc*p2304x1600YEsc*c22a100b97g2P
Esc*p2328x1600YEsc*c22a100b98g2P
Esc*p2352x1600YEsc*c22a100b99g2P
Esc*p2376x1600YEsc*c22a100b100g2P

```

```

Esc@a0c36Rescd@DColumn TestEsc@d@
Esc@a0c38RThis test puts
three columns of
text side by
side.
Esc@a101+0c38RThe second column
of text is printed
by moving the left
margin setting.
Esc@9
Esc@a39c38RThe third column
Esc@a39c39Ris produced by indenting
Esc@a39c40Reach line of text
Esc@a39c41Rthat is in the column.

```

(Sample Portals Page code continues)



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## DOS 3.3 BATCH Commands

Syntax and available commands may differ for prior versions.

## Replaceable parameter

**SYNTAX:** %n

n = 0 to 9; position of parameter on command line

## Environment variable

**SYNTAX:** %name%

name = environment variable (see DOS SET command)

## @-Hide line

**SYNTAX:** @batch-line

batch-line = line to execute w/o display

## CALL—Run another batch file

**SYNTAX:** CALL [d:]path\filename

[d:]path = drive/path for batch file

## ECHO—Control message display

**SYNTAX:** ECHO [ON|OFF|message]

ON = show lines as they execute

OFF = do not show lines

message = display message

## FOR—Repeat DOS commands

**SYNTAX:** FOR %variable IN (set) DO command

%variable = variable name

(set) = list of files; wildcards OK

command = DOS command using %variable

NOTE: FOR outside of batch file uses %, not %%.

## GOTO—Transfer control

**SYNTAX:** GOTO [label]

label—see under "LABEL"

## IF—Conditional execution

**SYNTAX:** IF [NOT] EXIST [d:]path\filename .ext command

—OR—

IF [NOT] string1 == string2 command

—OR—

IF [NOT] ERRORLEVEL n command

NOT = reverses logical condition

EXIST = TRUE if the specified file exists

string1 = string2 = TRUE if two strings are identical

ERRORLEVEL n = TRUE if previous program's exit code = n

command = DOS command line, executed if TRUE

## LABEL—Place marker for GOTO

**SYNTAX:** :string

string = 8 characters significant; period (.) not allowed

## PAUSE—Wait for keypress

**SYNTAX:** PAUSE [remark]

remark = message to display at pause

## REM—remark

**SYNTAX:** REM [remark]

remark = text up to 123 characters

## SHIFT—Allows over 10 %-parameters

**SYNTAX:** SHIFT

## DOS 3.3 CONFIG.SYS Commands

Syntax and available commands may differ for prior versions.

## BREAK—Extended Ctrl-Break checking

**SYNTAX:** BREAK = [ON|OFF]

ON = check during any DOS function

OFF = check only during I/O functions

## BUFFERS—Set disk buffers

**SYNTAX:** BUFFERS = x

x = no. of buffers (1.99; default 2, 3, 5, 10, or 15)

## COUNTRY—Country-specific data

**SYNTAX:** COUNTRY = xxx,yyy[,d:]path\filename .ext

—OR—

COUNTRY = xxx,yyy

xxx = country code

yyy = code page

[d:]path\filename .ext = name of COUNTRY data file

## DEVICE—Install device driver

**SYNTAX:** DEVICE = [d:]path\filename .ext

[d:]path\filename .ext = file containing device driver

## ANSI.SYS device—Extended I/O

**SYNTAX:** DEVICE = ANSI.SYS

## DISPLAY.SYS device—Code page switching for display

**SYNTAX:** DEVICE = DISPLAY.SYS COM[:](type[,hwcp][,m])

—OR—

DEVICE = DISPLAY.SYS COM[:](type[,hwcp][,s,m])

type = MCGA, CGA, LCD, EGA (use EGA for PS/2)

hwcp = hardware code page (437, 850, 860, 863, 865)

s = no. of prepared code pages (0..32)

m = no. of subfonts per page

## DRIVER.SYS device—Name disk device with letter

**SYNTAX:** DEVICE = DRIVER.SYS /D:ddd /T:ttt /S:ss /H:hh /C /N /F /J

/D:ddd = physical drive no. of (diskette 0.127, fixed 128.255)

/T:ttt = tracks per side (1.999, default 80)

/S:ss = sectors per track (1.99, default 10)

/H:hh = no. of heads (1.99, default 2)

/C = changeline support required

/N = nonremovable block device

/F /J = form factor

## PRINTER.SYS—Code page switching for printer

**SYNTAX:** DEVICE = PRINTER.SYS LPT#[:](type[,hwcp1,hwcp2,...])

—OR—

DEVICE = PRINTER.SYS LPT#[:](type[,hwcp1,hwcp2,...])

LPT# = printer 1, 2, or 3

type = 4201 (IBM Proprietary) or 5202 (IBM Quietwriter III)

hwcp = hardware code page (437, 850, 860, 863, 865)

n = no. of prepared code pages (0..32)

## VDSK.SYS—Virtual disk

**SYNTAX:** DEVICE = VDSK.SYS [comment][bbb][comment][ssz]

[comment][ddd][E:]

comment = string of ASCII characters 32..126 except slash

bbb = disk size in kilobytes (default 64)

ssz = sector size in bytes (128 (default), 256, 512)

ddd = no. of directory entries (2..512, default 64)

E = use extended memory

n = extended memory sectors transferred at once (1..8, default 8)

## FCBS—No. of file control blocks

**SYNTAX:** FCBS = m,n

m = max files opened by FCBS at once (1..255, default 4)

n = files protected from auto-closing if program tries to open more than m files

## FILES—Max. no. of file handles

**SYNTAX:** FILES = x

x = 8..255, default 8

## LASTDRIVE—Highest drive letter

**SYNTAX:** LASTDRIVE = z

z = letter A..Z, default E

## SHELL—Substitute for COMMAND.COM

**SYNTAX:** SHELL = [d:]path\filename .ext[/perm1] [/perm2]

[d:]path\filename .ext = main command processor

perm1 (for COMMAND.COM, E:xxxx = bytes for environ-

ment, where xxxx = 160..32768)

perm2 (for COMMAND.COM, /P = stay loaded, do

AUTOEXEC.BAT)

## STACKS—Set stack resources

**SYNTAX:** STACKS = s,a

s = stack frames (0..64)

a = frame size (0..32,512)

This PC Magazine Help File DOS Command Summary is the sixth in a series of handy pull-out reference cards we publish periodically. Just tear it out and pin it on your wall.

The list above is based on DOS 3.3, and it contains some commands and syntax that differ from prior or non-IBM versions of DOS. To run an external command on a hard disk system, it must either be in a directory listed on your PATH or you must specify the full path to it.

—Neil J. Rubenking



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## ■ PC LAB NOTES

```
Esc*p510x190YEsc*c5e200b0P
Esc(0UEsc(espl6.66h8.5v0s0b0TEacsl7c42Rthe vertical line is generated
Escs20c43Rusing the rule command.Esc(0UEsc(espl0b12v0s0b3T
Escs0c44REsc(10UEsc(espl10h12v0s0b3T
```

This box is produced by changing fonts and using the extended character set.

```
Esc(0UEsc(espl0h12v0s0b3T
Esc*p10x250YEsc*c3a200b0P
Esc*p10x250YEsc*c220a3b0P
Esc*p10x250YEsc*c3a104b0P
Esc*p10x250YEsc*c210a3b0P
Esc*p210x250YEsc*c3a203b0P
Esc*p10x270YEsc*c220a3b0P
Esc*p220x250YEsc*c3a107b0P
Esc*p10x265YEsc*c210a3b0P
Esc*p6x2625Y This box is produced by using the built in LaserJet Plus Rules.
```

EscE  
(Sample Portrait Page code ends)

ing that it is always in a predictable state.

One of the less than endearing things you quickly discover about laser printers is that they don't print and eject a page simply because the computer has stopped sending data. Entering

## DIR &gt; PRN

will only print and eject full pages in the listing; the final page remains in the maw of the printer's memory (signaled by a light above the Form Feed button on the LaserJet II) until you take the printer offline and hit the FF button. (You'll then inevitably forget to put the printer back online.) To avoid this hassle when you're experimenting or printing documents, the page eject command is useful. In HP's PCL it is

## Esc&amp;10H

The alternative is to take the printer offline, hit the Form Feed button, and then turn it back on-line again.

**BOLD AND UNDERLINED TEXT** If your word processor does not support bold or underlined text, this defect can be remedied with simple Escape sequences. You send the Escape sequence to turn on bold-facings just before the text is sent and send the command to turn off the bold just after the text is sent. To make all the following text appear in boldface, the necessary Escape sequence is

## Esc(s3B

To turn the bold printing off and return to the normal font, use the command

## Esc(s0B

Fonts other than those built into your printer may support several degrees of boldness. This is discussed in detail in the second part of this article. The default fonts in the LaserJet II do not allow variation in their boldness beyond allowing bold and normal characters.

The LaserJet supports two different underline commands. For the default fonts of the printer, you can use the fixed underline command. This enables the underline mode of the printer and prints an under-

■ A laser printer is inherently a page printer, not a character-by-character device.

score for every horizontal motion of the printer. To create a title consisting of several words that are to be underlined, turn the underline mode on, send the text for the whole title, and then turn off the underline mode. To underline the words of the title individually and not the spaces between the words, you must be able to turn the underline mode off and on again after each

word of the title. The Escape sequence to enable the fixed underline mode is

## Esc&amp;d0D

To return to normal printing use

## Esc&amp;d@

Text that is both bold and underlined can be produced by turning both modes on. Note, however, that since these Escape sequences do not share the same two initial characters, they cannot be combined into a shorter sequence. To activate bold and fixed underline modes simultaneously, you would use

## Esc(s3BEsc&amp;d0D

Each character in a font sits on an imaginary line called the baseline. The fixed-position underline always prints the underscore five dots below this baseline. A second, "floating-position underline" mode is used when there are several different-size fonts in the same line of text. In order to obtain a straight underline for them all, the floating-position underline mode calculates the distance below the row of characters in terms of the lowest position necessary for any of the fonts on that line.

**PAGE LAYOUT** Unlike most PC printers, laser printers do not work with continuous-form paper. The single sheets for most less-expensive printers are 8½ by 11 inches; only a few (including the HP) support legal or European page sizes. Purchasing a printer that accommodates still larger pages involves a lot of money—in the five-figure range. Since laser printers are equally comfortable printing in either portrait or landscape mode, however, you can use a "sideways" page layout without needing additional software or hardware.

The reason for this is that a laser printer is inherently a page printer, not a character-by-character device. All the information to be printed on a single page is sent to the printer and stored in its own memory. When a page is complete, the printer composes the page and then prints it. This provides great versatility in the printout. It allows the mixing of text and graphics on a page, as well as superimposition of text or a graphics image over what has already been printed in a specified area of a page.

Printing graphics and manipulating text





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## ■ PC LAB NOTES

positions require at least a rudimentary understanding of the concept of page layout. This is because the piece of paper to be printed on is not the same size as what, in HP's terminology, is called the "logical page." If you think of the printer as having a cursor—like the cursor on your display terminal—positioned "above" the point where the next character will print, then the area within which this imaginary cursor can be moved (the printable area) is a logical page.

Specifically, if you're using an 8½-by-11-inch physical page (in portrait mode), the maximum logical page size is 8 by 10 inches. Since the LaserJet (like most of today's laser printers) can print 300 dots per inch, horizontally or vertically, the dimensions of the physical and logical boundaries are often expressed in dots. The logical boundaries are a limitation imposed by the printing technique and the mechanism used to produce output. The default left and right margins of the LaserJet II are at the limits of the logical page (50 dots in on the left, 100 dots in on the right). By default, 150-dot margins are placed at the top and bottom. Within the logically addressable area, desired setting for the margins can be made using Escape sequences. (See the margins and text areas in the illustration "The Logical Page.")

**PRINTING TEXT** For most purposes, you define the margin settings for laser printers as you would when working with any other printer. The page is defined in columns and rows. Each of the margins is specified with units of columns for the left and right margins and rows for the top margin and text length. The size of a column or row is determined by the values for the horizontal and vertical motion indices, respectively. The default horizontal motion index (HMI) is defined in terms of movements of 1/100 inch; the default vertical motion index (VMI) is defined in terms of 1/48-inch motions. The current cursor position, where the next dot will be printed, is determined by the cursor's distance from the top-left-hand corner of the printable page.

The cursor can be moved around the page by specifying its position in rows and columns. The command to move the cursor to column 10 and row 4 is

**Esc@a10c4R**

Column/row printing instructions do not always have to be expressed in absolute terms, namely, with reference to the upper-left-corner reference point. They can be expressed relative to the current location of the cursor. To move the cursor ten columns to the right and four rows down from its current position, the command is

**Esc@a+10c-4R**

The plus and minus signs are used to indicate that the movements are relative to the current cursor position.

It is important to remember that the printer tries to execute every command that it is sent. Any series of Escape sequences can be sent to the printer *without* putting a carriage-return line-feed (CR-LF) between them. That is, you do *not* have to terminate an Escape sequence with <Enter>. This is especially important after the cursor has been positioned. If an Escape sequence that moves the cursor is sent directly before a series of text characters, the text that is on the same line will be indented. But if you hit Enter after moving the cursor, the line will not be indented but will be printed flush left, one line lower than you intended. To print all of the text indented, you should instead change the left margin. The command to change the

left margin so that it is 20 columns in from the left edge is

**Esc@a20L**

**PRINTING GRAPHICS** Thinking in terms of columns and rows does not represent adequate resolution when it comes to producing graphics on a laser printer. For graphics, instead of the cursor's position being referenced in columns and rows, distances along the x,y coordinates are expressed in terms of dots. The resolution for the cursor position on the LaserJet Series II, when specified in dots, is always 1/300 of an inch. Note that although the printer can print at reduced resolutions (150, 100, or 75 dots per inch), the physical location of the cursor for a given x,y coordinate does not change with the setting of the resolution. So to move the cursor from the 0,0 coordinate 1 inch in the horizontal direction and 2 inches in the vertical direction, you would specify the new coordinate as 300,600. Thus to move the cursor 1 inch in the horizontal direction and 2 inches in the vertical direction from the top-left-hand corner of the printable page, the Escape sequence is

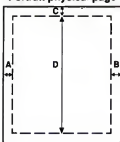
**Esc\*p300x600Y**

Again, in order to move the cursor with a relative motion, a plus or minus sign is used in front of the coordinate. To move

### The Logical Page

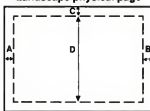
The logical page is the portion of the physical page that can be used when printing. Note that the dimensions are determined by the orientation—portrait or landscape—of the page.

**Portrait physical page**



**A=Left margin**  
**B=Right margin**  
**C=Top margin**  
**D=Text length**

**Landscape physical page**





## ■ PC LAB NOTES

## Sample Landscape Page

The landscape page shown here exemplifies many of the techniques discussed in the main article. A printout of the codes you would enter to produce the page for yourself follows. Be sure to observe the precautions in the accompanying caption.

The reset command that begins the page ensures that the printer starts from its known, default

state, but as this is normally portrait mode, the inclusion of the reset will cause a blank page to be ejected before the sample page is printed. (If you change your printer's default to use a landscape font, the same thing will happen when you shift to using a portrait page.) If you omit the reset, you must be quite certain of your printer's current state or you may get unpredictable results.

The first section of the landscape page is very similar to what you would use for a portrait page. Note, however, that the patterns are rotated to suit the page orientation: pattern number 1 prints hor-

izontal lines on the page. Both relative and absolute addressing are used.

The column test is the same as the one with which you previously experimented in portrait mode. Experimentation with the row number for this part of the test demonstrates that if the printer receives a CR-LF on the last line of the page it automatically ejects the page, forcing the rest of the page to be printed on the next sheet.

The right-hand side of this illustration demonstrates some of the many ways the rules and patterns can be combined to create ornate borders or

## PC MAGAZINE SAMPLE LASER PRINTER LANDSCAPE PAGE

### Standard Fonts available on LaserJet Plus and LaserJet series II

This is the Courier 10 pitch 12 point landscape font.

**This is the Courier bold 10 pitch 12 point landscape font.**

This is the Line Printer Compressed 16.6 pitch 8.5 point landscape font.

This is a sample of bold type.

**This is a sample of type that is bold and underlined.**

**This is a sample of type that is underlined.**

**This is a sample of type that is not bold or underlined.**

This row has fixed underlining in two different styles.

This row has floating underlining in two different styles.

### Standard Patterns built into LaserJet + and series II



### Standard Gray Scales built into LaserJet + and series II

Each of the one hundred rectangles is a different percentage of gray scale.

#### Ranges

1-20% 10% 21-35% 36-55% 56-80% 81-99% 100%



### Column Test

This test puts three columns of text side by side.

The second column of text is printed by moving the left margin setting.

The third column is produced by indenting each line of text that is in the column.

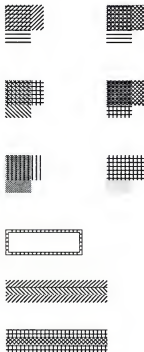
The vertical line is generated using the rule command.



simple logos. Using the cursor positioning commands, text can be placed on top of an area that has a rule or patterns. The first six samples show the patterns obtained from combining two patterns together. The next sample is an example of an ornate box using patterns number 1 and 2 and rules. The last two samples are borders consisting of three rows of patterns with a rule drawn between the top two rows.

The last command in the sample page is the reset command, which resets the printer to its default state and ejects the page.

### Combining Rules and patterns



the cursor 1 inch to the right and 1 inch up the page from its present position, the control sequence is

`Esc*p+300x-300y`

If you attempt to move the cursor to a position that is off the page the cursor is actually moved to the appropriate edge of the page. But if a text character to be printed falls completely or partly off the printable page, that character will not be printed at all. Graphics images are printed up to the edge of the logical page, and if they extend beyond the addressable cursor area they are simply truncated.

[In addition to being able to define cursor motions in terms of columns and rows ( $1/120$ - and  $1/48$ -inch motions) and in terms of dots ( $1/160$  inch, vertically or horizontally), the LaserJet II cursor position can be defined and moved in terms of "decipoints." One decipoint equals  $1/720$  inch. While the smallest printable dot is still  $1/160$  inch in diameter, a vertical or horizontal line of dots can be positioned in  $1/720$ -inch increments. This is of importance when it comes to microjustifying text, kerning letter pairs, and the like. This topic will be discussed in the second part of this article.—Ed.]

**SPECIFYING FONTS** As used with laser printers, a font is simply a set of characters that share the same basic characteristics. Fonts usually take their name from their typeface: Courier or Helvetica, for example. Each typeface is accompanied by a host of specifiable attributes, such as height, pitch (width), spacing, style, symbol set, stroke weight, and orientation. And each of these variables has its own Escape sequence in PCL, so fully specifying a font is going to involve a rather lengthy string of control characters.

In traditional typesetting, the size of a font is determined by its *height*, that is, by the distance between the top of the "ascenders" (the upper parts of such letters as *l*, *d*, and *h*), and the bottom of the "descenders" (the lower parts of letters such as *p*, *q*, and *g*).

This distance is expressed in "points," each nearly  $1/72$  inch. (Modern practice, followed by HP's PCL, is to define the point as  $1/72$  inch, not 0.013837 inch.) Point size is the most convenient way of talking about the size of a proportionally

spaced font such as Times Roman.

The *pitch* of a font is the number of characters that can be printed in one inch. For most people, this is the most convenient way to talk about fixed-width or *monospace* (typewriter-style) fonts. By a confusing coincidence, a 10-pitch (pica) font has a 12-point height, and a 12-pitch (elite) font has a 10-point height. All of the built-in fonts for the HP LaserJet series are fixed-width, which is why one of the first things you're likely to purchase for your laser printer is a cartridge or disk with proportionally spaced downloadable fonts.

The PCL *spacing* parameter for a font simply refers to whether the font has fixed

■ A 10-pitch (pica) font has a 12-point height, and a 12-pitch (elite) font has a 10-point height.

or proportional spacing. In a *fixed-spaced* font each character occupies the same width, and if the font is *proportionally* spaced the space occupied by different letters will vary. For example, *m* is a wide letter and will take up more room in a proportional font than the letter *i*.

In PCL terms, the *style* of a font is either upright or italic. Its *orientation* is either portrait or landscape. *Stroke weight* is either bold or medium (normal) for the LaserJet II's internal fonts, though different gradations are permissible when using downloaded fonts, which will be discussed more fully in the second part of this article.

The *symbol set* for a font comprises the actual characters you can print in it. While the LaserJet II supplies only two built-in typefaces (Courier and what HP calls "Line Printer"—see "Sample Portrait Page" and "Sample Landscape Page"), it can be set to generate any of 23 different symbol sets. For the alphabetic characters and numbers, there is little difference among these symbol sets, save that most U.S. fonts include the dollar sign where a European font is more likely to include the sign for pounds sterling. Naturally, the









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*"I live out...my life with the  
nightmare that the Soviet Union  
will one day discover...  
public relations."*

Marcia Piko, "If You Can, 1982

*"...the point,  
surely,  
isn't that  
Victorianism  
can't  
anaesthetize  
lust."*

National Review,  
June 26, 1965

# BUCKLEY

*"...a philosophical  
paella..."*

National Review, July 12, 1965

**"I would like to electrocute  
everyone who uses the word 'fair'  
in connection with income tax  
policies."**

National Review, July 12, 1965

*"...under the rubric  
of mutual  
assured destruction."*

National Review, July 12, 1965

*"Anthony Brogan reflected on  
the internationally practiced,  
slightly open-fingered, fingers-  
loosely-bent, counter-clock-  
wise-slow-motion royal wave..."*

High-Jinx, 1986





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printer (assuming the latter has a wheel with line drawing characters). The IBM extended character set can be used and the box drawn as a sequence of individual characters. Since the IBM PC symbol set is not the default for the HP LaserJet II (though you can make it so with a front-panel setting), to access these characters an alternate symbol set is needed. This is done in a fashion similar to selecting a new font. All of the parameters for that font would have to be selected: orientation, symbol set, spacing, pitch, and height. The Escape sequence to select one of the internal symbol sets that has line drawing characters is

**Esc(10UEsc(s0p10h12v**

Then, using the table "Decimal Conversion Values for Line Drawing Characters," you enter the codes that make up the box into the text editor after the font selection command line.

There are, however, less-cumbersome ways to draw boxes with a laser printer than to use a character-by-character approach. The HP LaserJet II has several predefined patterns called *rules*, which are resident and can be used to create any rectangular shape desired. Similarly, there are eight gray scales and six fill patterns. All are handled in a similar fashion. The cursor is placed at the top-left-hand corner of the desired position, and the width and height of the rule are entered, followed by the print command. To draw a solid black line 1 inch wide by 1/2 inch deep, use the following command:

**Esc\*c300a100b0P**

The values above are obvious when you remember that there are 300 dots in 1 inch.

The command to perform a solid fill is 0P. In order to print a rectangle the same size but with a 35 percent gray scale, the command is changed slightly to

**Esc\*c300a100b35g2P**

The 35g specifies the 35 percent gray scale, and the 2P is the command to print it. Any value for the gray scale percentage can be entered, but the resulting output will be in one of only eight levels.

Similarly, there are six fill patterns (numbered 1 through 6) built into the LaserJet series II, along with a number of

### Decimal Conversion Values for Line Drawing Characters

Decimal value	Character drawn	Decimal value	Character drawn
179		199	⌈
180		200	⌋
181		201	⌈
182		202	⌋
183		203	⌈
184		204	⌋
185		205	⌈
186		206	⌋
187		207	⌈
188		208	⌋
189		209	⌈
190		210	⌋
191		211	⌈
192		212	⌋
193		213	F
194		214	F
195		215	F
196		216	F
197		217	F
198		218	F

horizontal lines, vertical lines, diagonal lines from top right to bottom left, diagonal lines from top left to bottom right, a combination of vertical and horizontal lines, and a combination of the two diagonal line patterns. The command to print pattern number 6 the same size as the previous two rectangles is

**Esc\*c300a100b6g3P**

The 6g specifies the sixth pattern and the 3P is the command to print a pattern.

**FORMATTING COLUMNS** Using your knowledge of cursor positioning and the rules command, you can make the printer produce columns of text with a line drawn between them. Although the method for doing this is simple, in practice it can be time consuming.

The principle is to position the cursor at the top of the first column and send the first column of text. Now you reposition the cursor to the top of the second column and send a line, then move the cursor down one line and back over to the second column

and send the next line of text. All of your text should already be formatted so that no line exceeds the desired width for the column. When all of the text has been sent, the cursor is moved to the very top of the gap between the two columns and a rule is drawn between them.

There's one precaution to observe when using this method to produce columns. If a CR-LF is sent to the printer when the cursor is on the bottom line of the page, the printer will eject the page before it gets to printing the other column. To prevent this, set the page length to one line more than the desired length and send only enough text to reach the line above the bottom of the page for each column. Then, when all of the columns and the graphics rules have been sent, end with a page eject command.

The Escape sequence for setting the page length is

**Esc#l0P**

where the # sign represents the number of text lines that fall between the top margin



## ■ PC LAB NOTES

and the bottom of the page.

The best way to familiarize yourself with printing two columns of text with a rule between them is through examples.

(Note that we will be using the word

*column* in two different senses. Our example concerns two discrete columns of text, each roughly 18 characters wide. When we mention the 18th column position, of course, we are referring to a cursor loca-

tion 18 character spaces from the left margin—assuming a monospace font.)

Enter the command sequence:

```
Esc@a8c0RThis is a test
of two columns
of text to be
printed side
by side.
```

```
Esc@a18c0RNow see the second
Esc@a18c1Rcolumn of text
Esc@a18c2Rto be printed
Esc@a18c3Ralongside the
Esc@a18c4Rfirst.
Esc*p475x0YEsc*c5a250b0P
Esc@l0H
```

The first line sets the cursor position to the top-left-hand corner of the page, as defined in columns and rows. Then the text for the entire left-hand column appears. The next Escape sequence moves the cursor to the 18th column and the top row and prints the first line of the second column of text, followed by a CR-LF. The cursor is moved to the 18th column and row 1 then the next line of text is printed. The remaining lines for the second column are printed by first moving the cursor and then printing the line.

The penultimate line of Escape sequences moves the cursor to a position 475 dots from the left-hand edge and at the top of the page. Then a rule 5 dots wide and 250 dots long is drawn. To draw the rule from the top of the page, the position of the cursor needs to be defined in terms of dot units. If it had been specified in rows and columns, the line would have started at the base of the first line of text.

An alternative method for printing two columns involves changing the left margin on the page every time a new column is started. This involves less modification of your text file, since the Escape sequence is only necessary at the top line of each column. Remember to reset the left margin after printing the final column. The graphics rule will print regardless of the margin setting, provided absolute addresses are used.

Note the use of relative addressing for a new column's column position and absolute addressing for the row position. If an absolute position of 0,0 is used for the top row of text in a column, the text is printed on the far left-hand side of the page. The

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## ■ PC LAB NOTES

CR-LF character for the rest of the text in a column only moves the cursor to the left margin on the next line. It should be remembered that *absolute* positions, when referenced with dots, do not vary with the margin settings. To print the same example given above using new margin settings, the Escape sequence is

```
Esc@a@c@RThis is a test
of two columns
of text to be
printed side
by side.
Esc@a@l@l+c@RNow see the second
column of text
to be printed
alongside the
first.
Esc*p475x@YEsc*c5a25@b@P
```

EscE

The rules and patterns that are standard in the LaserJet series II can be used to

make far more ornate borders and boxes. A pale gray shade behind text can be used to provide a background for a logo or to highlight a section of text. For instance, a newsletter could look very stylish indeed if the address box for a review had a gray shade behind it. The principle is just a matter of using cursor positioning commands and avoiding sending a CR-LF on the bottom line of text before all the page has been transmitted.

**ENDLESS POSSIBILITIES** The "Sample Portrait Page" and "Sample Landscape Page" show only a few of the many possibilities available to you using nothing more than the standard features of the LaserJet series printers. The real-world applications are endless. The ability to produce brochures or simple newsletters with no additional cost is appealing to anyone with an interest in desktop publishing. Forms creation, using the rules feature, is

another attractive possibility. Provided that high-quality paper is used and it is allowed to relax between passes, the paper with the printed form on it can be put into the paper tray and re-fed into the printer for varying data to be added.

In Part 2 of this article I'll get into the use of alternate fonts, both custom-designed and commercially available. Additionally, I'll discuss the macro capabilities of PCL and its push and pop commands, which can contribute significantly to automating the process of producing custom output.

Even if it takes more than one long weekend to learn all this, the results of tapping your laser printer's full versatility should be more than satisfaction enough. ☐

*Caroline Halliday is an electrical engineering consultant with High Tech Aid and specializes in technical documentation and teaching for the PC environment.*

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■ UTILITIES ■ MICHAEL J. MEFFORD

# RUNNING PROGRAMS PAINLESSLY



*If some of your executable files are buried deep in your hard disk's subdirectory structure, RUN.COM will find its way to them even without a PATH statement.*

Grouping files into directories is the only alternative to chaos these days, and the bigger hard disks get, the more often you find yourself entering the MD command. The problem with using a directory structure, however, is that you then have to provide DOS with a path whenever you want to run a program that is stored outside your current subdirectory.

Typically, you lead DOS to your program in one of three ways: you use CD to change to the appropriate directory before running the program; you prefix the name of the file to be run with a complete path on the command line; or you direct DOS, via the PATH command, to look for the program in a specified set of directories. One or another of these methods serves well in most situations, but there are times when none work well at all.

Changing to the subdirectory that contains the desired program or prefixing the run filename with a path can be an annoying and error-prone task. All it takes is one typo and you have to reenter a long command string again. Of course, for frequently executed programs you could use a batch file to enter long commands. But I have an active directory structure that constantly changes, and creating new batch files is just another nuisance I can live without. On top of that, as DOS 2.x users are aware, you cannot prefix a run filename with a path.

Creating or appending the PATH statement in your AUTOEXEC.BAT file isn't always the best remedy, either. For one thing, you may occasionally wish to activate

an infrequently used program that does not warrant its residence in a directory designated by the PATH command. (Indeed, you may use such a program so infrequently that you can't even remember in which directory you stored it.) For another, the longer the PATH becomes, the longer it takes DOS to search all the specified avenues. And here again, an actively changing directory structure means you have to keep changing the PATH command as well.

To make matters worse, some programs can't find their overlays, help files, and the like unless your current directory is the one in which the program resides. Since the PATH command does not change directories, it's useless in such situations, so you're back to the CD command and manually entering a long path.

RUN.COM lets you avoid such trivial hassles and makes running programs painless. No more leading a blind DOS to your

program. You don't even have to know what directory the program is in. Simply enter RUN and the filename of your program and RUN will take care of finding the file. (You do have to add a drive request if the target file is on a different drive.) You can even control whether or not to change temporarily to the directory where the file is found by using the /C switch (change to the directory) or /S (stay in the current directory, the default).

After it executes a program, RUN restores the directory *status quo ante*, much as would putting a pair of CD commands around a program name in a batch file. For example, a common command chain in a batch file would be

```
CD \123
123
CD \
```

The same result can be obtained with the command

```
RUN/C 123
```

■ After it executes a program, RUN restores the directory *status quo ante*, much as would using a pair of CD commands in a batch file.

**GETTING AND USING RUN** Both the source code (RUN.ASM) and a BASIC program (RUN.BAS) that will automatically create RUN.COM are listed elsewhere in this article, but the easiest way to get a copy of the program is to download it from the PC Magazine Interactive Reader Service. Details are provided in the sidebar, "RUN by Modem." If you want the .ASM and/or .BAS files as well as RUN.COM itself, they, too, can be downloaded from PC-IRS, saving you the trouble of keyboarding.



## UTILITIES

```

;-----
; RUN.ASM
; Format: RUN [/C][/D:[directory]] filename [arguments]
; /C = Change to the directory and run
; /D = Stay in current directory and run
; Default is /D
;-----
CODE SEGMENT
ASSUME CS:CODE,DS:CODE
ORG 100H
START: JMP BEGINNING
;-----
; DATA AREA
;-----
COPYRIGHT DB "RUN 1.0 (c) 1987 EIFF Communications Co.,13,18
DB "PC Magazine #254," Michael J. Nefford,13,18,"8",28

CURRENT_DIR DB ?
WORKING_DIR DB ?
FILE_START DB ?
FILENAME_EXT DB ?
ANGLENGTH DB ?
PATH_END DB ?
CHANGE_FLAG DB ?
EXT_FLAG DB ?

EXTVAR DB 13,18,"System: RUN [/C][/D] [d:]path filename [args]"
DB 13,18,"/C = Change to the directory and run"
DB 13,18,"/D = Stay in current directory and run"
DB 13,18,"Default is /D"
DB 13,18,"?"

FAIL DB 13,18,"Can't find ?"
SEARCHING DB 13,18,"Searching for ?"
DELIMITER DB 9,13,32,"/\\*."
END DB "END"
CON DB "CON"
BAT DB "BAT"
ROOT DB "\",0
STAR_OVF_STAR DB "*,*",0
PARENT DB ".,",0
CURR DB ".,",0
CONFIRM DB "CONFIRM"

STACK_SEG DB ?
STACK_PTR DB ?

PARAMETER_BLOCK LABEL WORD
ENVIRONMENT DB ?
CUR_DIR_PTR DB ?
PARAMETER_1 DB ?
PCB_1ST DB PCB_SEG, ?
PCB_SEG DB PCB_SEG, ?

;-----
; CODE AREA
;-----
BEGINNING: MOV AX,0
MOV DI,OFFSET COPYRIGHT
INT 21H

;-----
; String moves forward.
CALL GET_DRIVE ;Save.
MOV CURRENT_DIR,AL ;Save.
MOV DI,OFFSET CURRENT_DIR ;Set current directory.
CALL GET_DIR

;-----
; Move the disk transfer address
; to the end of code to protect
; command line parameters at end.
MOV DI,OFFSET PCB_SEG ;Move the stack down to the
; end of code segment.
ADD DI,15 ;Round up paragraph size.

MOV CL,4
MOV AX,CL
MOV AX,640 ;Allocate rest of memory.
INT 21H

;-----
; Parse the command line parameters. Start by
; ascending off spaces and NOT = switch characters.
;-----
MOV SI,00H ;Point to command line parameters.
LODSB ;Get a byte.
CMP AL,0 ;Are there any?
JZ END_EXTVAR ;If no, exit.

;Get a byte.
CMP AL,0 ;Is it a switch character?
JNE CX_CX ;If no, check if end.
;Else, get switch character.
;Make sure not end.
MOV AL,13
JNE END_EXTVAR ;Capitaliza.
;Is it "C"?
JNE CX_CHANGE ;If yes, indicate to change dir.
;Else, is it "D"?
JNE CX_LEADING ;If yes, get next character.
;Else, adjust pointer back one.
;As possible path request.
;Save as possible start of filename
MOV FILE_START,DI

;-----
; So now have the start of the run file. Next asc
; to the end of filename looking for a path request.
;-----
NEXT_PATH: LODSB ;Get a byte.
CMP AL,0 ;Is it a request?
JNE CX_CX ;If no, check if directory.
MOV DI,[SI-2] ;Else, retrieve drive.
;Capitaliza.
MOV CX,"A"
CALL CHANGE_DRIVE ;Convert to DOS format.
MOV FILE_START,DI ;Save as possible start of filename
JMP SHORT NEXT_PATH

;-----
; Is it a path delimiter
; If no, see if end of filename.
; Else, save as path end.
; Save as possible start of filename
; then for tab, carriage return,
; space, tab, or redirection
; character as filename end.
; Continue until found.
CMP AL,"/"
JNE CX_DELIMIT
MOV PCB_END,DI
MOV FILE_START,DI
JNE NEXT_DELIMIT
MOV CX," "
CALL GET_DRIVE
MOV FILE_START,DI
JMP SHORT NEXT_PATH

;-----
; Else, adjust pointer back one.
; Save as start of arguments.
MOV ARGUMENTS,DI

;-----
; Param the arguments for the file control blocks.
;-----
MOV DI,OFFSET PCB_SEG ;Point to first PCB storage.
MOV AX,2000H ;Parse and scan off leading
INT 21H ;Separator.
MOV DI,OFFSET PCB_SEG ;Point to second PCB.
MOV AX,2000H
INT 21H

;-----
; Store run filename stripping extension in process.
;-----

```

(continues)

## RUN.ASM: The assembly language source code for RUN.COM.

The full syntax for RUN, with all its options, is

```
RUN [/C][/D:[directory]] filename [args]
```

The use of the optional /C or /S switches, as well as the /D: parameter for specifying a different drive, have been indicated above. RUN defaults to a diskwide search, but if you want, you can limit its attention by specifying a *directory* on the command

line. You can also add any necessary optional arguments (*args*) after your program's *filename*, just as you would at the DOS prompt. Should you forget its syntax, just enter RUN without giving a filename and the syntax options will be displayed. You do have to let DOS know where RUN.COM is (just store it in the root or in a directory pointed to by your PATH statement), but beyond that you can

forget about the tortuous task of entering paths and leave the driving to RUN.

**LIMITATIONS** RUN will be of special interest to DOS 2.x users, as it circumvents the inability of these earlier DOS versions to run a program with a path prefix. Of course, RUN has a few limitations of its own. For one thing, under DOS 2.x you can't run batch files with RUN's default /S



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## UTILITIES

<pre> CALL GET_DRIVE          ;Store working drive. MOV  WORKING_DISK,AL MOV  SI,OFFSET WORKING_DIR CALL GET_SES  MOV  SI,FILE_START MOV  SI,OFFSET FILENAME NEXT_FILENAME: POW  01 MOV  DI,OFFSET DELIMITERS MOV  CX,7 MOV  SCALAR MOV  DI POW  01 JZ   STORE_DOT STORE JMP  NEXT_FILENAME MOV  AL,"." STORE MOV  FILENAME_END,DI ;Store end of filename.  ;----- ; If a path was found, change directory and search for ; run file. Else, do a diskwide search for the run file. ;----- POW  00 MOV  SI,PATH_END CMP  SI,0 JZ   GLOBAL CMP  BYTE PTR [SI-3],"" JZ   CHANGE_IT CMP  BYTE PTR [SI-2],32 JZ   CHANGE_IT DEC  SI POW  01 MOV  BYTE PTR [SI],0 CALL CHANGE_DIR POW  01 CALL CH_DIRECTORY JNC  SI_T MOV  SI,0 JMP  GLOBAL GLOBAL: CALL GLOBAL_SEARCH JC   ERROR_EXIT CALL ERROR_EXIT JMP  ERROR_EXIT ;----- ; This is the exit routine. Restore the defaults the way we found them. ;----- ERROR_EXIT: MOV  SI,OFFSET PATH CALL PRINT_STRING CALL PRINT_STRING CALL PRINT_STRING CALL PRINT_STRING MOV  AL,1 JMP  SHOW_TERMINATE EXIT: MOV  AL,AL POW  00 CALL RESTORE_PATH POW  00 MOV  AL,0 JMP  \$ ;----- ; Subroutines ;----- ; This subroutine adds the extension COM, EXE and BAT ; to the path and checks to see if it exists. ;----- CH_DIRECTORY: MOV  AL,OFFSET FILENAME MOV  AL,FILENAME_END SI,OFFSET CH CALL FIND_BATCH JNC  CH_END MOV  SI,OFFSET EXE </pre>	<pre> CALL FIND_BATCH JNC  CH_END MOV  SI,OFFSET BAT CALL FIND_BATCH JZ   CH_END MOV  BAT_FLAG,1 ; If batch file, indicate so.  ;----- ;----- FIND_BATCH: MOV  SI,AL MOV  MOVN MOV  CX,7 CALL FIND_FIRST JZ   RET ; Add extension to filename. ; See if it exists.  ;----- ; This subroutine searches the file. If it's a batch file, load ; secondary copy of COMMAND.COM. Else, let 4th execute the file. ;----- EXEC: POW  00 POW  00 MOV  STACK_END,00 MOV  STACK_PTR,00 JZ   RET MOV  COM_LINK_PTR + 2,00 MOV  PTR_1ST + 1,00 MOV  PTR_2ND + 1,00 CMP  BAT_FLAG,1 JZ   EXECUTE MOV  SI,OFFSET COM MOV  SI,OFFSET PARAMETER + 1 ; Construct parameter. MOV  MOVN MOV  MOVN CALL MAKE_FILESPEC CALL ADD_PARAMETER ; Add file spec. ; Add arguments. MOV  AL,01[CH] MOV  DS,AX MOV  SI,AX ; Retrieve environment segment. ; Search for "CONSPEC". FIND_CONSPEC: JNC  AX MOV  SI,OFFSET CONSPEC MOV  CX,4 REPE  CMPS JZ   EXECUTE MOV  SI,OFFSET CONSPEC MOV  DS,AX JMP  EXECUTE ; What follows is COMMAND.COM path. ; Ready to execute. EXECUTE: MOV  SI,OFFSET FILESPEC CALL MAKE_FILESPEC MOV  SI,OFFSET PARAMETER + 1 CALL ADD_PARAMETER MOV  DS,OFFSET FILESPEC ; Construct arguments. EXEC_FILE: MOV  AL,OFFSET PARAMETER_BLOCK MOV  AL,0000 JMP  \$ ; Point to parameter block. ; Restore. CLI MOV  SP,CH+STACK_PTR MOV  SP,CH+STACK_END REI POW  00 POW  00 JZ   RET ; Restore segment registers. ;----- ;----- MAKE_FILESPEC: MOV  CHANGE_FLAG,1 MOV  FILENAME MOV  AL,FILENAME_END MOV  AL,"." MOV  MOVN MOV  MOVN MOV  AL,"." </pre>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

(RUN.ASM continues)

(stay in current directory) switch. I'll go into more detail about this problem shortly, and I'll show you a way to change the default with DEBUG so you don't have to remember to add the /C (change directory) switch to run batch files. In any event, however, this limitation does not apply to DOS 3.x users.

If you have RUN execute a batch file and the batch file makes changes to the environment with a command such as SET=, the changes will be lost when the

batch file ends. That's because the copy of the environment passed to the COMMAND.COM/C and the batch file is returned to the system pool once the batch file terminates.

If you change your mind during a diskwide search, any keypress will abort RUN's operation and return you to DOS. While this is a useful feature, it does preclude entering type-ahead commands for programs, as many power users like to do. One last precaution is to avoid using RUN

to execute resident programs. If you do, the code of RUN (and a secondary copy of COMMAND.COM, if the resident program is loaded from a batch file) will be trapped when the TSR terminates and stays resident. This wastes valuable RAM needed for other programs.

**HOW IT WORKS** In designing the utility, I considered several ways to approach RUN's primary job—the execution or spawning of another program. I first enter-







using it does present a difficulty for floppy disk-based systems. The disadvantage is that DOS will pester the floppy disk user to put a boot disk in drive A: to load the secondary copy of COMMAND.COM before the target file itself can be loaded and run. Further, loading COMMAND.COM/C will take some precious seconds and some precious memory. When possible, you don't want to make trade-offs in convenience in a program that's supposed to make life more convenient.

There is also one special situation in which the secondary command processor approach will not work. DOS 2.x will not execute a file that is preceded by a path. Try executing CABIN\RUN MYFILE in DOS 2.x, and the most DOS will do is change to the C: drive if you're not already there. (This problem was corrected with DOS 3.x, but there are still a lot of DOS 2.x users.) Curiously, however, the DOS 2.x EXEC function does not have any trou-

## ■ RUN's two-pronged approach uses EXEC for executables and loads COMMAND.COM/C to run batch files, producing the best of all worlds.

ble handling files with path prefixes. Ironically, COMMAND.COM ends up calling EXEC to execute a file. Why the discrepancy exists is a mystery to me.

In designing RUN, I finally settled on a two-pronged approach that uses EXEC for executables and loads COM-

MAND.COM/C to run batch files. This produced the best of all worlds, including enabling DOS 2.x users to run programs with paths.

RUN begins with the usual process of parsing the command line and stripping any extension that may have been provided by the user. RUN then either looks in the requested directory (if given) or does a diskwide search for a file with an extension of .COM, .EXE, or .BAT in that order. If an executable file is found (.COM or .EXE), 4Bh is given the task of executing the file. If a .BAT file is found, COMMAND.COM/C is put in charge. This solves the path problem—almost.

RUN either changes to the directory (if the /C option is specified), stripping the path before passing the filename as an argument to either EXEC or COMMAND.COM, or it passes the complete path and filename and stays in the current directory (the /S option).

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## ■ UTILITIES

This works fine for all circumstances except one: running a batch file under DOS 2.x with the default /S switch. That combination requires a filename that is prefaced with a path, a combination that the DOS 2.x COMMAND.COM can't digest. To handle batch files under DOS 2.x, then, the user must either use the /C switch or patch RUN to make this switch the default. (I'll discuss the simple patch required shortly.)

**PROGRAMMING TECHNIQUES** For programmers, RUN's greatest point of interest lies in the details of setting up EXEC and COMMAND.COM/C. The same technique is used by word processors that let you temporarily return to the DOS prompt, also used by DOS shell programs that eliminate the DOS prompt, and you may wish to use it in the design of your own applications.

EXEC (4Bh) is a powerful DOS func-

### DOS Function Call 4Bh (EXEC)

<b>AH</b>	4Bh
<b>DS:DX</b>	Pointer to an ASCII string of a filename to be loaded.
<b>ES:BX</b>	Pointer to parameter block consisting of more pointers.
<b>AL</b>	0 to load and execute the file pointed to by DS:DX. 3 to load program only (used by overlays).

tion call whose pointer-to-pointers structure (see the table "DOS Function Call 4Bh (EXEC)") may make it intimidating at first glance. It requires more preparation than most DOS calls. The call has two sub-functions that are controlled by the value in AL. If AL = 0, the program pointed to by

DS:DX is loaded and executed. If AL = 3, the program is just loaded without a program segment prefix. This latter is used to load overlays, which is not a concern for RUN, so I'll leave discussing the details to another day.

When invoking EXEC, the DS:DX pointer is to an ASCII string (a convention used by many of the other DOS function calls) of the file that's to be run. ES:BX points to a 14-byte parameter block to be used for the load (see the diagram "INT 21 Function Call 4Bh Parameter Block"). The parameter block is in itself a string of four pointers.

The first pointer is a word that points to the environment that will be copied for use by the child process. (The pointer need only be a segment pointer, since the environment always starts on a paragraph boundary, i.e., has an offset of zero.) The child process, namely, the program that RUN is going to spawn and give control

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## ■ UTILITIES

INT 21h Function Call  
4Bh Parameter Block

ES:BX → WORD
Segment address of environment, placed at 2Ch of PSP. (Zero offset assumed.) Set segment to zero if parent's environment is to be inherited.
DWORD
Pointer to command line image to be placed at 80h in the Program Segment Prefix (PSP).
DWORD
Pointer to File Control Block (FCB) to be placed at 5Ch in the PSP.
DWORD
Pointer to second FCB to be placed at 6Ch.

Parameter block pointed to by ES:BX when AL=0 (Load and execute)

to, should inherit the same environment given to RUN by COMMAND.COM. The location of this environment pointer can be found at offset 2Ch in the program segment prefix (PSP).

DOS understands that in most cases the child process should inherit the same copy of the environment, and so it makes it easy to set up the environment address by interpreting a segment address of zero to mean "use the parent's environment." RUN takes advantage of DOS's astuteness by initiating the first word of the parameter block with a zero. (For more information on the environment, see the excellent two-part PC Lab Notes in *PC Magazine*, March 31 and April 14, 1987.)

The three remaining pointers in the parameter block are double-word pointers and are stored in the backward offset segment form. The first double-word pointer is to a command line that will be placed at 80h in the PSP of the child process. The command line has the same format that any program receives when it is loaded at the DOS prompt, namely, a byte containing the length of the arguments (not counting the terminating carriage return) follow-

ed by the command string (including any delimiting leading spaces).

The next two double-word pointers are to FCBs (file control blocks) to be placed in the loaded program's PSP at 5Ch and 6Ch (see the "File Control Block Fields" diagram). Since the introduction (with DOS 2.0) of the easier-to-use filehandles, file control blocks are not much used by programs any more. Some of the older programs, however (*WordStar* for one), still get their arguments from the FCBs. One drawback of FCBs is that they do not support paths. (That's one of the reasons your document must be in the same directory in order for *WordStar* to find it.)

When DOS loads a program, then, not only are the command line arguments placed at 80h, but also the first two arguments, if any, are parsed and placed at 5Ch and 6Ch, respectively. This duplication of the command line parsing keeps DOS downwardly compatible for the sake of those programs that still use FCBs.

One aspect of FCBs that can still be profitably used by modern programs is the drive specifier. When DOS parses the command line, if a valid drive is detected, its identification is placed in the first byte of the FCB. Thus, a program interested in a drive as an argument need only look at 5Ch instead of parsing the command line.

So, to accommodate every type of program, RUN follows DOS's lead and constructs two FCBs to be passed to the spawned program. An FCB in its simplest form is the byte containing the drive specifier followed by a filename. The drive

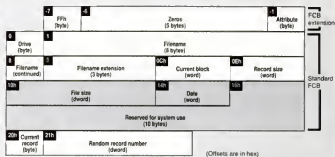
■ One aspect of FCBs that can still be profitable to modern programs is the drive specifier. A program interested in a drive need only look at 5Ch.

specifier will be zero if none was found; 1 = A:, 2 = B:, 3 = C:, etc. After the drive specifier byte there follow eight bytes for the file's name and three for its extension (the delimiting dot is not used).

To parse the command line and construct the FCBs for the sake of those few programs that use them would seem an unduly tedious chore, but fortunately, from the same antique world of FCBs comes a matching DOS call that makes the process a piece of cake. You simply point to the arguments with DS:SI and to a portion of memory with ES:DI and call function 29h. DOS then does its work of filling out an FCB. Indeed, if you make the call with AL = 1, DOS takes care of parsing off any delimiters such as leading spaces.

With the Parameter Block filled out, the stage is almost set to execute the call. First, however, some room must be made to load the program. When RUN was loaded,

## File Control Block Fields





## RUN BY MODEM

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The Eastern modem number for PC-IRS is (212) 696-0360. In the West, call (415) 598-9100. Set your modem and communications software to use 2400/1200/300 bps, 8 data bits, 1 stop bit, no parity. Files with a .COM, .EXE, or .ARC extension require use of the Xmodem error-checking protocol; files with .ASM or .BAS extensions can be downloaded using either regular ASCII or Xmodem.

If you use the Xmodem protocol, you can download RUN.COM directly, saving typing or downloading either the .BAS or the .ASM version. RUN.BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create RUN.COM when run once in BASIC. RUN.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Micro-soft, Version 2 or later) and the following commands:

```
MASH RUN;
LINK RUN;
EXE2BIN RUN RUN.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.



## RUN Command

Michael J. Mefford

1988 No. 3 (Utilities)

**Purpose:** Executes .COM, .EXE, or .BAT files from any disk directory without requiring changing directories or specifying a path to the file.

**Format:** RUN [/c[/s]][d:][directory]filename [args]

**Remarks:** Unless the optional *directory* parameter is specified, RUN defaults to a diskwide search to find the executable *filename*. Any additional arguments (*args*) that would normally be specified on the DOS command line may be added to the *filename* that RUN is called upon to execute. A drive specifier (*d:*) must be used if the file to be run is not on the current drive. During its search, any keypress will abort the operation of RUN.COM.

RUN can either operate from the current directory (its default mode, designated by the optional /S switch) or it can change to the directory (/C) in which it finds the desired program before executing it. The /C option is required by programs such as *WordStar*, which can find their overlay files only when loaded from within the directory in which they are stored. The /C option is also required to run .BAT files under DOS 2.x (see Note below).

**Note:** RUN overcomes the inability of DOS 2.x to handle .COM and .EXE files that are prefixed with a path. Batch files under DOS 2.x, however, still require RUN's /C option. If desired, the /C option can be made the RUN default mode, with /S as its selectable alternative. To make the change, put a copy of RUN in the same directory with DEBUG.COM and enter the following commands:

```
DEBUG RUN.COM
E 15B 1
E 1E8 "C"
W
Q
```

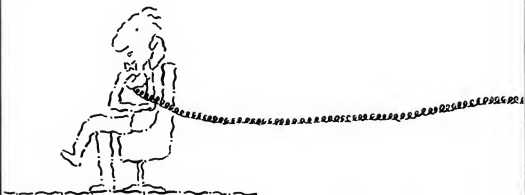
If you later upgrade your version of DOS and wish to reverse the process, use the same procedure with the following commands:

```
DEBUG RUN.COM
E 15B 0
E 1E8 "S"
W
Q
```









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## ■ UTILITIES

fused with RUN's /C switch), as an argument, followed by the name of the batch file and its arguments. The DOS /C switch ensures that the second copy of COMMAND.COM will not become resident, hogging valuable RAM, but will instead be discarded when the batch file is finished running.

EXEC has to be able to find COMMAND.COM. Instead of going on a diskwide search, RUN looks in the environment for the COMSPEC= string. This will be followed by the path to COMMAND.COM placed there by DOS when the machine was booted. This string will usually be the first string in the environment, but I found no documentation guarantee of that, so RUN does a search for the string in the environment.

Perhaps the best way to put all this in perspective is to follow through an example, step by step. Suppose you enter

```
RUN MYFILE A:\ARG1 B:\BIN\ARG2.COM
```

Let's further suppose that RUN found MYFILE.EXE in its diskwide search. Since this is an executable file, EXEC will handle the load. DS:DX would be pointed to MYFILE.EXE followed by a byte of zero. The command line pointed to by the Parameter Block would start with 24 followed by the 24 argument string characters

```
A:\ARG1 B:\BIN\ARG2.COM
```

Note that the A: is preceded by a delimiting space and is followed by a carriage return. The carriage return does not count in the length of the string.

If RUN found MYFILE.BAT instead, then DS:DX would be set to point to COMMAND.COM in the environment. The command line would start with 27 followed by the 27 bytes

```
/C A:\ARG1 B:\BIN\ARG2.COM
```

again followed by the carriage return. In each case the two FCBs would be filled out by function 29h as follows: The first would start with a 1 (drive A:), followed by

```
ARG1xxxxxxxx
```

(where x represents the space character). The second would start with a 2 (for drive B:), followed by

```
ARG2xxxxxCOM
```

Note that the FCBs omit the path and dot.

You may have wondered why RUN strips the extensions before searching for an executable file. RUN does this to stay consistent with COMMAND.COM. That's right. COMMAND.COM itself strips the extension and then looks for an executable file. As a matter of fact, if you do add an extension, say .EXE, and there is a .COM file with the same name in the same directory, DOS will strip the extension and execute the .COM file! Try it. Assuming you already have RUN.COM, enter RUN.EXE. Sure enough, RUN.COM will be loaded. COMMAND.COM fol-

■ If you add an extension, say .EXE, and there is a .COM file with the same name in the same directory, DOS will strip the extension and execute the .COM file!

lows a very regimented command order. It first looks at its internal commands (such as DIR or TYPE). Next, it looks for an executable file found with extensions in a preordained order. The scan sequence is .COM, .EXE, and .BAT. Last, it looks in the environment for a PATH statement. If none of these are satisfied, it returns with the "Bad command or file name" message.

**DISKWISE SEARCH** If no path is included, RUN does a diskwide search for a run file. The routine used here is borrowed from one of my earlier programs, SEARCH (Programming/Utilities, *PC Magazine*, February 24, 1987). I also used it in REPEATS (June 9, 1987). It implements a systematic search up and down the directory tree starting from the root directory, enlisting the assistance of the DOS calls Find First (4fh) and Find Next (4fh). An index technique is employed, keeping

track of the number of subdirectories in each directory. The details can be found in the assembly listing under the label GLOBAL\_SEARCH.

**MODIFYING RUN** Now for the DEBUG session I promised. To change the default of RUN to /C (change directory) before running a file, a change DOS 2.x users may want to make in order to run batch files, enter

```
DEBUG RUN.COM
E 15B 1
E 1E8 "C"
W
Q
```

Conversely, to change the default back to /S (stay in current directory), enter

```
DEBUG RUN.COM
E 15B 0
E 1E8 "S"
W
Q
```

One final note. For performance reasons, many of my programs address the hardware directly. This is particularly true when it comes to writing directly to the screen buffer. In addition, I frequently use a BIOS call instead of a DOS call. If you've been following Charles Petzold's *Environments* column, you may find it refreshing that RUN uses DOS exclusively for service support. When OS/2 finally takes hold, programmers will be required to access the system entirely via DOS calls. Direct hardware manipulation will be a no-no.

Fortunately, with OS/2 will also come a rich set of new calls that cover not only the BIOS calls but many other needed services. OS/2 will be a welcome new operating system releasing us from the guilt of bypassing DOS and the subsequent problems in incompatibility and nonportability across machines.

RUN will relieve you of the mundane drudgery of entering lengthy paths. You may find more uses for RUN than I've suggested. At the same time, the assembly listing of RUN will serve as a model of how to shell out to a child process. ☐

Michael J. Mefford is a contributing editor of *PC Magazine*.



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# UNDERSTANDING THE OS/2 KEYBOARD



*A simple program, PAGE, demonstrates how to program keyboard I/O under the OS/2 Kernel; plus a tip on how to avoid speed degradation during OS/2 multitasking.*

From the viewpoint of an application program, the keyboard is not a particularly complex device. The keyboard simply generates a stream of codes that the operating system stores in a circular buffer and then passes on to the program. Consequently, the part of the operating system's Application Program Interface (API) devoted to the keyboard is usually simple and straightforward.

The OS/2 Kernel is no exception to this rule. If you've worked with the keyboard in MS-DOS and with the PC BIOS, you'll find that the OS/2 keyboard interface is quite similar.

Under MS-DOS, a program can obtain keyboard input or clear the keyboard buffer through several low-number MS-DOS functions calls (01h, 06h, 07h, 08h, 0Ah, 0Bh, and 0Ch). These calls date back to DOS 1.0 and actually originated in CP/M. DOS supports reading standard input through function call 3Fh ("Read from a file or device"). Standard input is normally keyboard input, but it can also be redirected so it comes from a file or from another program through a pipe.

Many application programs that run under DOS obtain keyboard input through interrupt 16h, which is part of the PC BIOS. Interrupt 16h has three function calls that let a program read the next key from the buffer, peek at the key without removing it from the buffer, and obtain the state of the shift and the toggle keys on the keyboard. RAM-resident pop-ups (and some application programs), on the other hand, obtain keyboard information directly from the hardware. These programs intercept inter-

rupt 09h and access the keyboard I/O ports.

OS/2 has facilities that duplicate and improve upon the functionality of all these DOS and BIOS keyboard functions. One improvement I'm sure will be appreciated is the size of the keyboard buffer. The PC BIOS has a 15-key buffer; under OS/2 the buffer is expanded to 61 keys.

**READING STANDARD INPUT** An OS/2 program can read standard input using the DosRead function. In C, a call to DosRead looks like this:

```
DosRead (0, &Buffer,
         BufferLen, &BytesRead);
```

[The above is a single line.—Ed.] The first parameter of 0 means to read standard input, which is normally the keyboard. The function reads up to BufferLen bytes into the area of memory pointed to by the Buffer address. The last parameter is a pointer

to a variable that receives the number of bytes actually read by the function.

In general, however, DosRead is not a good function for simply obtaining keyboard information. It is most valuable in programs designed to work with redirected standard input, such as the PAGE program presented later in this column.

**READING KEYBOARD INPUT** The OS/2 functions devoted to the keyboard all begin with the letters Kbd. The most important keyboard input function is KbdCharIn:

```
KbdCharIn (&KeyData, NoWaitFlag, 0);
```

This function obtains the next key from the keyboard buffer. The function is roughly equivalent to a BIOS interrupt 16h call with AH equal to 0.

The first parameter to KbdCharIn is a pointer to a structure of type KeyData. For C programmers, this structure is defined in the SUBCALLS.H header file included with the June 1987 release of the OS/2 Software Development Kit. (The names and contents of these header files may be different in the OS/2 Software Development Kit expected out in 1988.)

The KeyData structure has six fields that OS/2 uses to return keyboard information to the program. The table "Fields in the KeyData Structure" lists these fields. The char\_code and scan\_code fields are equivalent to the two codes returned in registers AL and AH when a DOS program calls interrupt 16h with AH equal to 0. The char\_code field is usually the ASCII character code of the key pressed and the

■ OS/2 has facilities that improve upon all the DOS and BIOS keyboard functions. One sure to be appreciated is the size of the keyboard buffer.



## ■ ENVIRONMENTS

## Fields in the KeyData Structure

Field	Data Type
char_code	Unsigned char (1 byte)
scan_code	Unsigned char (1 byte)
status	Unsigned char (1 byte)
nls_shift	Unsigned char (1 byte)
shift_state	Unsigned int (2 bytes)
time	Unsigned long (4 bytes)

scan\_code field is the hardware scan code. However, if the char\_code field is 00h, then the key is a noncharacter key, such as a function key or a cursor movement key. In that case, the scan\_code field contains the extended keyboard code. These extended codes are the same as those used by the PC BIOS under DOS.

The status and nls\_shift fields are used for supporting double-byte character sets for some foreign-language keyboards. ("NLS" stands for "national language support.") These two fields are not yet documented well enough to make head or tail of how they work.

The 16-bit shift\_state field provides the state of all the keyboard shift and toggle keys at the time the key was pressed. The definition of the shift\_state bits is shown in the diagram "Shift and Toggle Key Information."

There seems to be a little confusion about the time field in the KeyData structure. The prerelease documentation accompanying the OS/2 Software Development Kit indicates that the four bytes give the time in terms of hours, minutes, seconds, and hundredths of a second. However, under the beta version of the OS/2 Kernel, the time field reports an elapsed time in milliseconds between the time the system was booted and the time the key was pressed.

A program can use the time field to determine how long the keystroke has been waiting in the keyboard buffer. The current elapsed time (measured from the system boot) is stored in what is called the "global information segment," the address of which is available from the DosGetInfoSeg function.

The second parameter to KbdCharIn is called the "no-wait flag." Normally, the KbdCharIn function waits for a keystroke if the keyboard buffer is currently empty. The function does not return control to the program unless it returns the next key. However, if you set the no-wait flag to 1, then KbdCharIn returns immediately even if the keyboard buffer is empty. If both the char\_code and scan\_code fields are set to 0, then no keystroke was available from the buffer. This parameter has important implications for multitasking, as I'll discuss later in this column.

The last parameter to KbdCharIn is a "keyboard handle." Under the OS/2 Kernel, this must be set to 0.

Like the PC BIOS interrupt 16h, KbdCharIn returns only key presses, not key releases. The key is not echoed to the screen. The toggle keys and shift keys do not generate key codes that are stored in the buffer. Instead, you obtain the current status of these keys from the shift\_state field of the KeyData structure. The Insert key is an exception: it generates an extended keyboard code and affects the shift\_state word.

**OTHER KEYBOARD FUNCTIONS** If a program wants to look at the next keystroke in the keyboard buffer without removing it, you can implement the

KbdPeek function instead of KbdCharIn:

```
KbdPeek (&KeyData, 0);
```

The char\_code and scan\_code fields of the KeyData structure are set to 0 if no key is waiting in the buffer. This function replaces the BIOS interrupt 16h call with AH equal to 1.

A program can clear the keyboard buffer by calling

```
KbdFlushBuffer (0);
```

The single parameter is the keyboard handle, which must be set to 0.

A program can obtain the state of the toggle and shift keys by a call to KbdGetStatus. The state of the toggle keys can be changed using KbdSetStatus. (Under DOS, changing the state of the toggle keys requires the program to access the BIOS data area directly.)

The KbdStringIn function is useful for obtaining a string of characters from the keyboard:

```
KbdStringIn (&buffer,  
            &KbdStringLength, NowaitFlag, 0);
```

[The above is a single line of code.—Ed.] This function replaces the DOS function call 0Ah. The second parameter is a pointer to a structure of type KbdStringInLength. It contains an input length on entry to the function, and it contains the number of bytes entered by the user on return to the program. During the KbdStringIn call the normal DOS editing keys (F3 and so forth) can be used to edit text that is already in the buffer.

Like DOS, OS/2 allows the redefinition of keys using ANSI control sequences. These keyboard redefinitions are recognized only by the DosRead and KbdStringIn functions. But don't assume that KbdStringIn reads standard input. KbdStringIn reads the keyboard regardless of the redirection of standard input.

In one sense, DosRead and KbdStringIn play a unique role in keyboard handling. It is analogous to the role of DosWrite and VioWrite in screen output. This is summarized in the table "Screen Output and Keyboard Input Functions."

**THE PAGE PROGRAM** Let's now take a look at an example of DosRead and KbdCharIn in action in a rather simple program

## Screen Output and Keyboard Input Functions

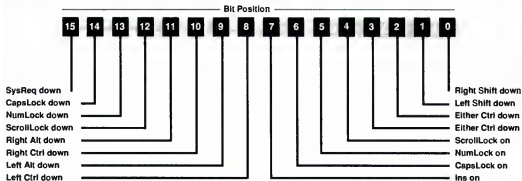
Screen output	Can be redirected	Works with ANSI
DosWrite	●	●
VioWrite	○	●
All other Vio functions	○	○
<b>Keyboard input</b>		
DosRead	●	●
KbdStringIn	○	●
All other Kbd functions	○	○

How OS/2 screen output and keyboard input functions work with redirection and ANSI control sequences.

● Yes ○ No



## Shift and Toggle Key Information



Shift and toggle key information obtained with the OS/2 KbdCharIn function.

that makes use of both functions.

The PAGE.C program shown in Figure 1 is similar to the DOS (and OS/2) MORE program. It displays standard input one screenful at a time. However, unlike the teletype output of MORE, PAGE uses the OS/2 Vio functions to pop each page to the full screen.

Using the C compiler included with the beta version of the OS/2 Software Development Kit, you can compile and link PAGE with the following command:

```
CL -G2 -Zp PAGE.C
```

You can use PAGE to look at the contents of a large file thus:

```
PAGE <filename
```

Or you can display standard output originating from another program through a pipe. For example, if you have a long directory list, you can look at it a screen at a time with

```
DIR | PAGE
```

PAGE is easy to use. Pressing any key goes to the next page. The Esc key exits.

PAGE first determines whether standard input is coming from a source other than the keyboard by calling DosQHandType ("query handle type"). If standard input is coming from the keyboard, PAGE exits with an error message. Otherwise,

the program saves the initial contents of the screen with VioReadCellStr and later restores it with VioWrtCellStr. PAGE writes to the screen using the OS/2 virtual screen buffer. The VioGetBuf function obtains a selector (segment address) for this buffer. The program then stores its screen output in the buffer and updates the screen through a call to VioShowBuf.

PAGE reads standard input using DosRead with a first parameter of 0. PAGE reads the keyboard with KbdCharIn. The keyboard handling is very simple. When KbdCharIn returns with the next key, PAGE checks only if the char\_code field of the KeyData structure is '\x1B' (the Escape key). This causes PAGE to terminate. PAGE also terminates when it runs out of standard input to display. This is indicated by a zero value for BytesRead following the call to DosRead.

**OS/2 PIPES** Piping of standard output from one program to standard input of another program is significantly different in OS/2. In DOS, if you run the command

```
DIR | MORE
```

DOS first creates a temporary file for the output from the DIR command. Standard output from DIR is redirected to this file. When the DIR command is finished, DOS closes the file. DOS then runs the MORE

program. The standard input to MORE is redirected from the file. When MORE is finished, DOS deletes the temporary directory file.

Under OS/2, pipes are memory blocks rather than files. As you would expect, this speeds up piping considerably.

Even more important, the programs on each side of the pipe run simultaneously. While the DIR command is writing its standard output to the pipe, MORE (or PAGE) can read its standard input from the pipe. This means that PAGE does not have to wait for the DIR command (or whatever) to finish before it displays the first screenful of standard input to the screen.

You'll notice that near the end of PAGE.C (just before the program terminates), PAGE continues reading standard input using DosRead until the BytesRead variable is zero. An earlier version of PAGE did not have this code. With this earlier version, if I executed

```
DIR | PAGE
```

for a long directory and ended PAGE by pressing the Esc key, the DIR command would give me an error message that the disk was full. What DIR really meant was that the pipe was broken because PAGE stopped reading DIR's output. Adding the two lines of code at the end of PAGE.C fixed this problem.



## ■ ENVIRONMENTS

```

/*=====
(C) 1987, Riff-Davis Communications Company
Programmed by Charles Petzold, 10/87.
=====*/

#include <os2calle.h>
#include <subcalle.h>

MAIN ()
{
    static char      Screen[] = "PAGE: Requires piped standard input ";
    struct KeyData   kd;
    struct ModeData  md;
    unsigned int      HandlerType, Plugged, BytesWritten,
                     ScreenSize, ScreenWidth, BytesRead,
                     AnsiMode, Row, Col, InputIndex;
    unsigned long     ScreenBuffer;
    char far          VirtualScreen;
    char far          Buffer (1024);

    /*=====
    Check if Standard Input is keyboard
    =====*/
    DOSQUERYDRIVE (0, &HandlerType, &Plugged);
    if (HandlerType == 1)
    {
        DOSWRITE (2, &Screen, sizeof Screen - 1, &BytesWritten);
        return 1;
    }

    /*=====
    Get video Mode & calculate screen size
    =====*/
    md.Length = sizeof (md);
    VIDEOGETMODE (&md, 0);
    ScreenSize = md.Col * md.Row + 2;

    /*=====
    Reserve current screen in allocated segment
    =====*/
    DOSALLOCED (&ScreenSize, &ScreenWidth, 0);
    ScreenBuffer = (char far *) (unsigned long) ScreenWidth << 16;
    VIOREADCELLS (&ScreenBuffer, &ScreenSize, 0, 0, 0);

    /*=====
    Use API to clear screen to current attribute
    =====*/
    VIOGOTOXY (&AnsiMode, 0);
    VIOFILL (1, 0);
    VIOGOTTY ("^[H^[2J^[u", 10, 0);
    VIOGOTOXY (&AnsiMode, 0);

    /*=====
    Get virtual screen buffer
    =====*/
    VIOGETBUF (&VirtualScreen, &ScreenSize, 0);
    VirtualScreenPtr = (char far *) VirtualScreen;

    InputIndex = 0;

    do
    {
        /*=====
        Clear virtual screen buffer characters
        =====*/
        for (Col = 0; Col < 2 * md.Row + md.Col; Col += 2)
            VirtualScreenPtr[Col] = ' ';

        Row = 0;

        Col = 0;

        while (Row < md.Row)
        {
            /*=====
            Read standard input
            =====*/
            if (InputIndex == 0) InputIndex = BytesRead;
            DOSREAD (0, Buffer, sizeof (Buffer), &BytesRead);
            if (BytesRead == 0)
                break;
            InputIndex = 0;

            /*=====
            Fill up virtual screen buffer
            =====*/
            switch (Buffer [InputIndex])
            {
                case 0x0D:
                    if (Col != 0)
                        Col--;
                    break;

                case 0x0A:
                    Col = (Col + 8) % 7;
                    break;

                case 0x0B:
                    Row++;
                    break;

                case 0x0D:
                    Col = 0;
                    break;

                default:
                    VirtualScreenPtr [2 * (Row * md.Col + Col)] =
                        Buffer [InputIndex];
                    Col++;
                    break;
            }
            if (Col == md.Col)
            {
                Col = 0;
                Row++;
            }
            InputIndex++;

            /*=====
            Update screen & get character
            =====*/
            VIOWRITE (0, ScreenSize, 0);
            VIOCHARIN (&kd, 0, 0);
            while (BytesRead > 0 && kd.char_code != '\n');

            /*=====
            Restore screen & "empty" standard input
            =====*/
            VIOWRITECELLS (&ScreenBuffer, md.Col * md.Row + 2, 0, 0, 0);
            DOSFREED (&ScreenSize);

            while (BytesRead > 0)
                DOSREAD (0, Buffer, sizeof (Buffer), &BytesRead);

            return 0;
        }
    }
}

```

Figure 1: PAGE.C, a program that displays standard input in pages.

## KEYSTROKES AND MULTITASKING

Now for a lecture.

There's been a lot of disinformation about OS/2 circulated in recent months. Most of this stuff apparently originates with the CEOs of companies who compete with Microsoft in the applications and languages market. Lazy press people who have never run OS/2 for themselves and don't know any better pass these falsehoods on to the public.

One quite persistent piece of disinformation concerns multitasking. It is said

that if you have two programs running under OS/2, they'll both run at half speed. After all, OS/2 must continually switch between the two programs, so each program gets only half the microprocessor time it previously was allocated under DOS. Seems obvious, doesn't it?

Well, no.

It is obvious only if both programs are actually doing something at the same time, such as recalculating a spreadsheet, running a spelling check, or sorting a database. However, most programs spend

much of their time doing nothing except waiting for the next keystroke from the user.

If an OS/2 program is running in a background screen group and is waiting for a keystroke with a call to KbdCharIn or KbdStringIn, then that program implicitly forfeits its normal time slice. Because the program is not going to get a keystroke until the screen group is moved to the foreground, there's no reason for the program to eat up valuable time doing nothing. OS/2 knows this and functions accordingly.



ly. OS/2 is simply not as stupid as some people think. I wouldn't be wasting my time learning about OS/2 and writing about OS/2 if it were.

Anybody who's spent time with OS/2 knows this: You can have a bunch of screen groups active, each running a program, and if each of these programs is waiting for a keystroke, there is no significant speed degradation.

However, in order for OS/2 to work this way, it is important that application programs call KbdCharIn with the no-wait flag set to 0. This allows OS/2 to recognize that it should not give the program a normal time slice if the keyboard buffer is empty. If a program instead sits in a loop and continually calls KbdCharIn with the no-wait flag parameter set to 1, then the program will indeed get a normal time slice and it will slow down the system.

But why would a programmer want to set the no-wait flag to 1 anyway? Well, suppose the program used both keyboard input and mouse input. An OS/2 program obtains mouse events (movement of the mouse or mouse button depressions) by calling the MouReadEventQue function. This function has its own no-wait flag parameter. Setting this flag to 1 causes MouReadEventQue to return control to the program even if the mouse queue is empty.

One way to handle both keyboard and mouse input is to alternate between reading the keyboard with KbdCharIn and reading the mouse queue with MouReadEventQue. The no-wait flag in both functions is set to 1, so the program won't miss mouse input while it's hung up in a KbdCharIn call and won't miss keyboard input while waiting for MouReadEventQue to return.

While such a method sounds reasonable, it's wrong, wrong, wrong! A program that does this will slow down the whole system, even when the program is running in a background screen group and cannot possibly get keyboard or mouse input. And I promise you that any commercial OS/2 program we see that works in this way will be classified personally by me as an "Editor's Reject."

But now we apparently have a problem. What recourse does a program have when it must be prepared to read both keyboard and mouse input?

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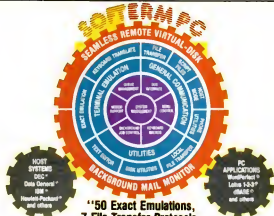
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A Presentation Manager program obtains more information about keystrokes than does an OS/2 Kernel program. In particular, every keyboard event (not only key releases, but closures as well) is reported to the program. Presentation Manager programs also obtain key combinations that are completely ignored by the OS/2 Kernel, such as the Ctrl key in combination with the period.

## COMING UP: KEYBOARD MONI-

**TORS** So far we've seen how OS/2 duplicates the functionality of the DOS interrupt 21h and BIOS interrupt 16h keyboard functions. However, we haven't seen anything yet that lets a program intercept keyboard information in the same way that a DOS RAM-resident program does with interrupt 09h.

Is such a thing possible under OS/2? It sure is. In fact, unlike DOS, OS/2 has a documented, built-in facility that lets a program intercept and (optionally) alter keyboard input before it gets to other programs.

This is certainly an important topic, which is why I'll devote all of next issue's Environments column to the subject of "keyboard monitors." ☐



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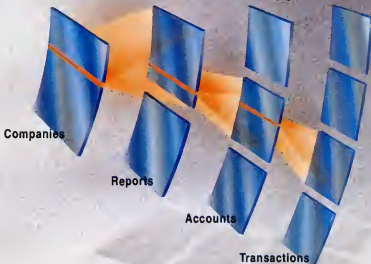
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# FROM ASCII STRINGS TO BINARY BITS



*C offers a library full of functions that convert numbers entered in ASCII into values the computer can use. This issue presents some equivalent routines in assembler.*

In the last few columns, we've covered the various ways in which a C or a MASM program can get information about its runtime environment. We've looked at command line parameters and their addresses, and we've examined a number of routines to find, add, or change strings in the program's environment block. In the next few installments, we'll turn our attention to the area of input and output. We'll review the library routines available to the C programmer and develop similar routines for use in MASM.

Let's start with a very fundamental problem: converting numeric ASCII strings into their equivalent binary values. Imagine that a program prompts the user for a numeric value of some sort and then issues a request to MS-DOS or to a C library routine to read a string from the keyboard. When the program gets control back from the read operation, its buffer will contain a sequence of ASCII characters, terminated by some special character (depending on the input function). The ASCII character values must be converted by the program into binary data that can be combined with or compared to similar data by the machine's arithmetic and logical instructions.

For example, if a MASM program uses interrupt 21h function 3Fh to read a string from the keyboard, and the user types

100 <Enter>

the program's buffer will contain the following sequence of bytes:

31h 30h 30h 0Dh 0Ah

These correspond to the ASCII digits "1", "0", "0", followed by a Carriage Return (0Dh) and Line Feed (0Ah). Before the program can proceed to do useful work with the user's entry, it must convert this string of bytes into the binary value 0064h, or 100.

**C CONVERSION FUNCTIONS** The C runtime library contains a number of different routines to convert strings to binary data (see the table "C Data Conversion Functions"). These range in power from `atoi`, which converts strings representing integers, to `scanf` and its relatives, which can perform any conversion operation you can think of (and some you wouldn't think of). For the present, we will confine our discussion to `atoi` and its cousins `atol` and `atof`, which convert strings to long (4-byte) integers and double-precision (8-byte) floating-point numbers, respectively.

All three of these functions accept a pointer to an ASCII string as their only argument, and all return the value of the string as the value of the function. All three ignore leading white space (blanks or tabs) in the string and stop converting the string at the first character they consider invalid. Thus, for `atoi` and `atol`, a valid numeric string takes the form

`[w][sign][digits]`

and `atof` converts a string of the form

`[w][sign][digits][.digits][E|e][sign][digits]`

Each field shown in square brackets is optional, and the variables are defined in the table "Variables of C Data Conversion Functions."

The program `ATOX.C`, shown in Figure 1, is a simple test bed that you can use to experiment with the functions `atoi`, `atol`, and `atof`. The program prompts you for a string and then converts it with

## C Data Conversion Functions

Function	What it does
<code>atoi</code>	Converts string to integer in base 10.
<code>atol</code>	Converts string to long integer in base 10.
<code>atof</code>	Converts string to floating-point number in base 10.
<code>strtod</code>	Converts string to double integer in specified base.
<code>strtol</code>	Converts string to long decimal integer in specified base.
<code>scanf</code>	Converts one or more ASCII arguments in buffer according to format string, and stores results into specified variables.



## ■ POWER PROGRAMMING

## Variables of C Data Conversion Functions

Variable	Definition
<b>w</b>	white space (any combination of blanks and tabs)
<b>sign</b>	a "+" or "-" character
<b>digits</b>	some combination of the characters "0" through "9"
<b>E</b>	exponent delimiter, one of the characters "e", "E", "d", or "D"

each of the three functions just described, displaying the results of the conversions with `printf` (a complex formatting library function that we'll look at in detail later).

While playing with `ATOX`, observe the results returned from `atoi` and `atol` when you enter a floating-point number or a very large integer. Look also at the results returned by all three functions when you enter a string with nonnumeric characters or no string at all. You will notice that the three conversion functions always return some reasonable-looking value, even if it is bogus. If a floating-point number is entered, `atoi` and `atol` return the mantissa portion as an integer and ignore the exponent; if an integer greater than 32,767 is entered, `atoi` returns garbage; if nothing is entered, all three functions return zero.

A program that uses these functions has no way to tell if the converted number overflowed, or if an otherwise valid string contained a bad character that terminated the conversion prematurely. Nor could such a program even distinguish between a zero value that represents an absent string and one that represents a string containing the digit "0". Of course, the C runtime library contains more-powerful functions that *do* allow you to validate numeric strings before or during conversion, and we'll turn our attention to these in due course.

## MASM CONVERSION FUNCTIONS

Figures 2 and 3 contain the source code for two MASM functions, `ATOI` and `ATOL`, which are equivalent to the C library `atoi` and `atol`. Both require the address of an ASCII string of the form

```
[ whitespace ][ sign ][ digits ]
```

in registers `DS:SI`, and both terminate on

the first invalid character. `ATOI` returns a 16-bit result in register `AX`, while `ATOL` returns a 32-bit result in registers `DX:AX` (with the most significant half in `DX`).

The source code for `ATOI` is straightforward and uncomplicated. The source code for `ATOL` (Figure 3) follows the same logic but contains a couple of useful tricks. The lines between `atoi3` and `atoi4` demonstrate the technique for multiplying a 32-bit quantity by 10 by adding copies together. This is special-case code, of course; the general problem of multiplying a 32-bit value on an 8086/88 requires that

you perform the multiplication in 16-bit pieces and then add together the intermediate results. The lines between `atoi4` and `atoi5` show how to obtain the negative value of a 32-bit quantity on a 16-bit machine: the two's complement is obtained by first taking the one's complement of each half and then adding 1 to the result.

In order to test these MASM conversion routines from a C program, you can wrap a little C procedure shell or "binding" around them that preserves the C register variables, sets up a proper stack frame, fetches the address of the string into register `SI`, and calls the MASM procedure. Upon return, the binding need only restore the register variables and discard the stack frame: `ATOI` and `ATOL` already return their results in the proper registers expected by the C compiler.

For example, the procedure `TRYATOI` in Figure 4 is the C language binding to the MASM procedure `ATOI`, and the little `TRYC` program in Figure 5 illustrates a

```

/*
    ATOX.C -- Ray Duncan, October 1987
*/

#include <stdio.h>
#include <stdlib.h>

main(int argc, char *argv[])
{
    char buff[80];
    int ivar;
    long lvar;
    double xvar;

    while(1)
    {
        printf("\nEnter a number (Q to quit): ");

        gets(buff);

        /* read string from keyboard */

        /* exit if 'Q' or 'q' entered */
        if( buff[0] == 'Q' || buff[0] == 'q') break;

        /* convert in various ways */
        ivar=atoi(buff); /* string to int */
        lvar=atol(buff); /* string to long int */
        xvar=atof(buff); /* string to double prec. real */

        /* now display results */
        printf("\n\t atoi(your entry) = %d ", ivar);
        printf("\n\t atol(your entry) = %ld ", lvar);
        printf("\n\t atof(your entry) = %e \n", xvar);
    }
}

```

Figure 1: `ATOX.C`, a program that demonstrates the C functions `atoi`, `atol`, and `atof`.



## PRODUCTIVITY

```

name      etoi
page      55,132
title     etoi - ASCII to integer

; Copyright 1987 Ziff Communications Co.
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;
; Call with: DS:SI = address of string
;
;           where 'string' is in the form
;
;           [whitespace][sign][digits]
;
; Returns:  AX = result
;           DS:SI = address+1 of terminator
;
;           other registers preserved
;
; Like the C library 'atoi', this routine gives no
; warning in the event of overflow, and terminates
; on the first invalid character.

blenk    equ    30h      ; ASCII blank character
tab      equ    39h      ; ASCII tab character

_TEXT    segment word public 'CODE'
         assume cs:_TEXT

atoi:    public  atoi
         proc    near      ; ASCII to 16-bit integer

         push    bx        ; save registers
         push    cx
         push    dx

         xor     bx,bx     ; initialize forming answer
         xor     cx,cx     ; initialize sign flag

atoi:    lodsb            ; scan off whitespace
         cmp     al,blenk  ; ignore leading blanks

```

**Figure 2:** *atoi.asm* converts an ASCII string to a 16-bit decimal integer.

```

name      etol
page      55,132
title     etol - ASCII to long integer

;
; Copyright 1987, Ziff Communications Co.
; Ray Duncan
;
; Call with:  DS:SI = address of string
;
;           where 'string' is in the form
;
;           [whitespace][sign][digits]
;
; Returns:   DX:AX = result (high word in DX)
;           DS:SI = address+1 of terminator
;
;           other registers preserved
;
; Like the C library 'etol', this routine gives no
; warning in the event of overflow, and terminates
; on the first invalid character.
;
;
blank     equ     20h           ; ASCII blank character
tab       equ     09h           ; ASCII tab character

_TEXT     segment word public 'CODE'
;
; assume cs: TEXT
;

```

**Figure 3:** *ATOL*. *ASM* converts an ASCII string to a long (32-bit) decimal integer.



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## ■ POWER PROGRAMMING

<pre> jb      atol4      ; jump if not '0' to '9' cmp     al,'9' ja      atol4      ; jump if not '0' to '9'  and     ax,0f0h    ; isolate lower four bits push    ax          ; and save digit value  mov     ax,bx      ; previous answer x 10 mov     di,dx      ; DI:AX = copy of DX:AX  add     bx,bx      ; * 2 adc     dx,dx  add     bx,bx      ; * 4 adc     dx,dx  add     bx,ax      ; * 5 adc     dx,di  add     bx,bx      ; * 10 adc     dx,dx  pop     ax          ; add this digit </pre>	<pre> add     bx,ax      ; to forming answer adc     dx,0  jmp     atol2      ; convert next digit  atol4:  mov     ax,bx ; result low half to AX         jcxz    atol5 ; jump if sign flag clear          not     ax    ; take 2's complement         add     ax,1  ; of DX:AX         adc     dx,0  atol5:  pop     di    ; restore registers         pop     cx         pop     bx         ret         ; back to caller  atol    andp _TEXT   ends end </pre>
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

(Figure 3 ends)

call to TRYATOI. To assemble, compile, and link them all, follow these steps:

```

MASM /zi ATOI;
MASM /zi TRYATOI;
CL TRY.C TRYATOI ATOI

```

The first two commands convert ATOI.ASM and TRYATOI.ASM into ATOI.OBJ and TRYATOI.OBJ, respectively. The last of the three commands runs the C compiler to convert TRY.C into TRY.OBJ, then links TRY.OBJ, TRY-ATOI.OBJ, and ATOI.OBJ into the executable program TRY.EXE.

The TRYATOI procedure's name has a leading underscore (\_) character. This is because the C compiler automatically prefixes that character to any symbol it encounters. You can use almost identical code to bind and test the ATOL.ASM routine from a C program, but be sure to declare ATOL as "long" rather than "int" at the beginning of TRY.C, or the C compiler will simply throw the upper half of the result away.

Next time, I'll present some routines to convert 16-bit and 32-bit binary values to ASCII strings, wrap all of these routines up into a MASM example program, and then proceed to more-sophisticated conversion routines that provide some error checking and the ability to handle floating-point numbers. Meantime . . .

**HIGH NOON AT THE C CORRAL** In case you haven't noticed, the marketing of C compilers has turned into open warfare. Microsoft and Borland are both running

multipage four-color advertisements, seemingly in any magazine that will sell them the space. Meanwhile, the other vendors of C compilers for MS-DOS (Computer Innovations, Lattice, Mark Williams, DeSmet, Ecosoft, and Datalight)

have nearly faded from view altogether in the commotion.

The reason for all the excitement is, of course, that both Microsoft and Borland have released a new generation of C compilers (Quick C and Turbo C) that provide

```

;
; TRYATOI.ASM -- Ray Duncan, October 1987
;

_TEXT segment word public 'CODE'

assume cs:_TEXT

extrn atoi:near

public _TRYATOI
_TRYATOI proc near ; ival=TRYATOI(char *)

    push bp ; set up stack frame
    mov bp,sp
    push si ; save register variables
    push di

    mov si,[bp+4] ; get address of string
    call atoi ; convert it

    pop di ; restore registers
    pop si
    pop bp
    ret ; return result in AX

_TRYATOI endp

_TEXT ends

end

```

Figure 4: TRYATOI.ASM, a C language binding (small model) for ATOI.ASM.



## ■ POWER PROGRAMMING

```

/*
   TRY.C -- Ray Duncan, October 1987
*/

#include <stdio.h>

int TRYATOI(const char *); /* declare function */

main(int argc, char *argv[])
{
    char buff[80];          /* keyboard input buffer */
    int iwar;               /* an integer variable */

    while(1)
    {
        printf("\nEnter a number (Q to quit): ");

        gets(buff);         /* read string from keyboard */

        /* exit if 'Q' or 'q' entered */
        if( buff[0] == 'Q' || buff[0] == 'q') break;

        /* call NASM binding */
        iwar=TRYATOI(buff); /* string to int */

        /* now display result */
        printf("\n\tTRYATOI(your entry) = %d ", iwar);

    }
}

```

Figure 5: TRY.C demonstrates the binding of TRYATOI ASM and ATOI ASM to a C program.

a completely integrated development environment à la the immensely popular Turbo Pascal. These products allow you to edit rapidly and to compile, link, and test your C code with the aid of pull-down menus and hotkeys. They also eliminate the complex, laborious, and baroque command lines that usually accompany C software development. Both Quick C and Turbo C offer performance and code quality comparable to the best mainline C compilers you could buy a year or so ago. And each costs less than \$100.

I've been using both Turbo C and Quick C for some time, and I'll try to make sure that any C programs published here will work equally well with both. Both products have particular strengths and weaknesses you should take into account when deciding which to buy.

Quick C has a user interface similar to QuickBASIC's and is easier to use with a mouse. The hotkeys seem to be assigned

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more or less at random (Shift-F5 compiles and runs a program, for example) and have little or no mnemonic value. Quick C's strongest features are its graphics library, its integrated debugger (which is more or less the same as CodeView), and its full compatibility with Version 5.0 of Microsoft's flagship C compiler.

Turbo C has essentially the same editor and command interface as the other Borland languages, so if you are a veteran Turbo Pascal user you will find Turbo C very comfortable. The design and colors of the Turbo C screens and menus are attractive, and the hotkey assignments are relatively intuitive and easy to remember. On the other hand, Turbo C does not contain an

■ The intense marketing of C compilers seems to be a matter of company prestige, not money.

integrated debugger, does not support the mouse, and has no graphics functions.

Either product will serve you well. The intense marketing efforts for these products seem to me to be more a matter of company prestige than of money to be made. For example, most of the mail-order houses are selling Turbo C and Quick C for around \$65. Let us assume that the markup by the retailer is at least 25 percent, and that the fixed manufacturing and shipping cost per copy to Microsoft or Borland is \$10 (probably conservative).

If these figures are in the right ballpark, Microsoft and Borland are netting a maximum of \$40 per copy, from which they must finance the color advertisements (\$10,000 or more per page in the top magazines), underwrite technical support, and recover their development (Microsoft) or acquisition (Borland) costs. Even if both companies sell 250,000 copies (which would be enormous success for a programming language), the potential return seems to be small shakes indeed compared with the profit potential of something like Microsoft Excel or Borland's Quattro. ☐

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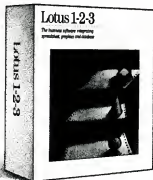
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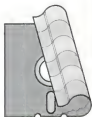
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## ■ DOUGLAS COBB AND STEVEN COBB

# SPREADSHEET CLINIC



*Eliminating unwanted rows at printout time; designing menus for prompting users; attaching applications in Symphony and 1-2-3 using an error-trapping macro.*

## INFORMATIONAL MENUS

The menu macro command, /xm, provides a handy alternative to 1-2-3's /xl command for presenting informational prompts—that is, prompts that do not solicit information from the user of the macro. To create these prompts I use a /xm command that references the cell containing the message I want to present to the user. Because the cells to the right of the message cell are empty, 1-2-3 presents a menu that contains the message I want to present as its only option. And since the message is the only item on the menu, 1-2-3 highlights it. When you press Enter, 1-2-3 continues executing the macro two cells below the one with the message.

Figure 1 contains a simple example of the technique. When you execute this macro, 1-2-3 presents a custom menu that has the entry in the cell named PROMPT as its only choice, then pauses until you press Enter. When you do, 1-2-3 will continue executing the macro in the second cell below PROMPT. The commands in this cell instruct it to print the range named REPORT.

Don Nummi, Jr.  
Superior, Wisconsin

*This is a useful and clever technique for presenting informational prompts. In addition to working with Release 1A's /xm command, it also works with the {MenuBranch} and {MenuCall} commands in Releases 2 (and later) in 1-2-3, and in Symphony.*

*Unfortunately, however, Mr. Nummi's macro does not envisage the possibility of*

*the user pressing the Esc key. When you press Esc while viewing a custom menu, 1-2-3 breaks from the menu and continues executing the macro with the command that follows the /xm command that created the menu. In the case of the macro shown in Figure 1, 1-2-3 would continue executing the macro with the statement in PROMPT that would command it to type the characters, "Make sure your printer is ready, then press Enter to continue . . . ." This is not at all what you would want the program to do.*

*To prevent this, you could append the command /xg/p - to the end of the first statement in the macro. That statement would route 1-2-3 back to the beginning of the menu if you pressed Esc while viewing the custom menu. 1-2-3 would continue to redisplay the prompt until you pressed Enter to continue the macro, or pressed Ctrl-Break to cancel it. Alternatively, you could leave a blank cell between \p and PROMPT. That way, 1-2-3 would cancel the execution of the macro if you pressed Esc instead of Enter.*

*If you wish to provide additional information to the user, you can enter it into the cell below the one that contains the menu choice. When 1-2-3 creates the menu, it will display the entry from that cell on the third line from the top of the screen. Unlike*

*the information on the second line (the menu choice itself), this information will not be highlighted.*

## HIDING ROWS

In your comments to Andrea McFarlane (Spreadsheet Clinic, *PC Magazine*, September 29, 1987) about hiding rows when printing, you suggested the simplest procedure would be to copy the worksheet, delete the unwanted rows in the copy, then print and discard it. Two points should be noted about that technique.

First, if the rows you want to exclude contain entries that are referenced by formulas elsewhere in the worksheet, you must be sure to use the /Range Values command to convert those formulas into values before you delete the rows. Otherwise, the results of the remaining formulas will be affected.

Second, if you use Release 2.0 or 2.01 of 1-2-3, or any release of Symphony, there's an easier way to hide rows when you print a worksheet. To do this, insert a column immediately to the left of the leftmost column you want to print. Next, enter two vertical bars ( | | ) into the cells of this column in the rows you want to keep from printing. Since 1-2-3 will interpret the first vertical bar as a label prefix, only the second bar will be visible in each cell.

```

\p      /xmPROMPT
PROMPT  Make sure your printer is ready, then press Enter to continue...

        /pprREPORTagq
  
```

Figure 1: You can use single-item custom menus to display informational prompts.



## ■ SPREADSHEET CLINIC

	A	B	C	D	E	F
			1987	1988	1989	Total
1						
2						
3		SALES				
4		Product 1	\$128,888	\$145,320	\$172,630	\$446,838
5		Product 2	\$118,680	\$127,980	\$158,580	\$397,880
6						
7		Total Sales	\$249,480	\$273,230	\$323,130	\$845,760
8						
9		EXPENSES				
10		Cost of Goods Sold	\$143,888	\$156,880	\$185,880	\$486,480
11		Operating Expenses	\$59,143	\$65,371	\$79,480	\$203,914
12						
13		Total Expenses	\$202,143	\$221,371	\$264,480	\$687,914
14						
15		Pre-tax Income	\$47,257	\$51,859	\$58,730	\$157,846
16		Tax	\$23,629	\$25,938	\$29,365	\$78,923
17						
18		After-tax Income	\$23,629	\$25,938	\$29,365	\$78,923
19						
20						

Figure 2: Cells A3..A6, A8..A12, and A15 of this worksheet contain double vertical bars.

	1987	1988	1989	Total
Total Sales	\$249,480	\$273,230	\$323,130	\$845,760
Total Expenses	\$202,143	\$221,371	\$264,480	\$687,914
Pre-tax Income	\$47,257	\$51,859	\$58,730	\$157,846
Tax	\$23,629	\$25,938	\$29,365	\$78,923
After-tax Income	\$23,629	\$25,938	\$29,365	\$78,923

Figure 3: This figure shows the results of printing the range A1..F20.

Next, set the print range so that this column is the leftmost column in the range. Now when you print the worksheet, 1-2-3 will skip the rows that begin with the double vertical bars.

Figures 2 and 3 provide a before-and-after example of this technique. Since cells A3, A4, A5, A6, A8, A9, A10, A11, A12, and A15 in Figure 2 contain the double vertical bars, 1-2-3 will omit rows 3-6, 8-12, and 15 from the printout. Thus, Figure 3 shows the result of printing the range A1..F20 of the worksheet that's shown in Figure 2.

If you wish, you can hide the column that contains these special entries so it will not affect the horizontal spacing of the report. This column affects which rows 1-2-3 prints even when it is hidden.

Craig W. Mason  
McMurray, Pennsylvania

*Mr. Mason is right; the technique he describes works in both 1-2-3 (Release 2 and later) and Symphony. Overall, it is easier and more flexible than the technique we had earlier advocated. When you want to hide rows from the printout, you include*

*the column of double vertical bars as the leftmost column in the print range. When you want to include the rows in the printout, you just respecify the print range to exclude the double-barred column. For some computers, a single vertical bar will work just as well.*

#### A TRAP FOR APPS

I like to use the following line in my Symphony macros whenever I need to invoke an add-in application:

```
{IF@ISERR(@APP("APPNAME", ""))}
(SERVICES)aaAPPNAME~q
```

(APPNAME is a placeholder for the name of the application. Note also that the above must be a single, continuous line, not the two lines shown.) This line will attach the application if it is not already attached without running the risk of an "Application is already attached" error.

Here's how it works. When Symphony executes the line, the function

```
@APP("APPNAME", "")
```

determines whether or not the application APPNAME is attached. If the application

is not attached, this function will return the value ERR, which will make the surrounding @ISERR function true. If @ISERR is true, then Symphony will execute the command that follows the {IF} command on the same line:

```
{(SERVICES)aaAPPNAME~q}
```

This command attaches the application APPNAME to Symphony. The next line of the macro then invokes the application.

If the application is attached, then the @APP function will return its second argument—in this case, a blank string. In that event, the @ISERR function will be false and the {IF} command will tell Symphony to skip the remaining commands on the current line and to proceed directly to the next line, which would invoke the application. Skipping the remaining commands on the same line also skips the "Application is already attached" error that will occur whenever you try to attach a macro that is already attached.

Figure 4 shows an example of this line in a real macro. This macro first determines whether DOS.APP is attached. If it is, then the second line simply invokes the DOS.APP application, exiting to DOS to run the batch file GET\_ENV. If the application is not attached, then the second part of the first line attaches it. Once the application is attached, the macro moves on to line 2.

Vincent D. deCaria  
Layton, Utah

*Mr. deCaria's tip is right on track. You should always use his "app trap" whenever you need to invoke an application in a macro.*

*The heart of the trap is the still-undocumented Symphony function @APP. The form of the function is*

```
@APP("APPNAME", true value)
```

*where APPNAME is the name of an application and true value is a string or value that you want the function to return if the application APPNAME is attached. The APPNAME argument can be a string—enclosed in quotes—or a reference to a cell that contains a label. The APPNAME should not include the extension .APP. If the application is attached, the function will return the true value. If the*







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■ PAUL SOMERSON

# USER-TO-USER



*Programs to streamline ERRORLEVEL branching and give you control over your system's CMOS clock—plus a quick-and-dirty one-line DOS calculator.*

## ERRORLEVEL MADE EASY

Lots of short .COM programs can read the keyboard and set the ERRORLEVEL accordingly to allow batch file branching, but most look for one or two predefined keys and set the same ERRORLEVELS each time.

I wrote OPTION.COM to make the whole process far easier. You can create it by typing in the OPTION.SCR DEBUG script in Figure 1 using any pure-ASCII word processor or the DOS COPY CON command. Be sure to leave a blank line above RCX, and hit the Enter key after each line, especially the last one.

Then put it on the same disk with DEBUG.COM and type

**DEBUG < OPTION.SCR**

If you'd prefer, type in the OPTION.BAS BASIC listing in Figure 2.

To use OPTION you must give it pairs of parameters on the command line. The first character in each pair is the key pressed and the second is the ERRORLEVEL code generated. For example, if you entered

**OPTION A1B2**

OPTION would return an ERRORLEVEL of 1 if you hit A, or 2 if you typed B. To allow uppercase and lowercase entries, you would change it to

**OPTION A1a1B2b2**

OPTION can also display on-screen prompts. Follow the parameter pairs with a hyphen and the message to be displayed.

For example,

**OPTION y1InB88-Enter Y or N:**

with two spaces at the very end displays the prompt "Enter Y or N:" and positions the cursor two spaces from the colon.

OPTION lets you use the Enter key by representing it as a plus sign. So, you could say

**OPTION +1 8-Hit Enter for 1, Space for 0**

(Be careful not to insert extra spaces in the string of argument pairs unless you actually want the Spacebar to count as a valid key.)

If you include an odd number of key-press arguments, OPTION uses the last character as the ERRORLEVEL. It returns if any key other than the one in the previous valid pair is pressed. So if you try

**OPTION +1B**

the program will generate an ERRORLEVEL of 1 if Enter is pressed or 0 for any other key.

If you need ERRORLEVEL values greater than 9, you can use the ASCII characters immediately following 9.

**OPTION J:L=**

will return a 10 if J is hit or a 13 if L is hit, since in the ASCII sequence the character immediately follows 9 and the = sign is four characters after 9. Consult the ASCII chart in the back of your BASIC manual for help.

OPTION prompts the user for a key-press by beeping. It also beeps when it stumbles over an illegal key, discards such

N OPTION.COM	JZ 126
A	CMP AL,DL
MOV SI,82	JZ 14D
MOV DI,SI	PUSH AX
LODSB	LODSB
CMP AL,D	CMP AL,D
JZ 126	POP AX
CMP AL,2D	JZ 14E
JNZ 103	JMP 13B
MOV AL,D	LODSB
STOSB	SUB AL,30
XOR BH,BH	PUSH AX
MOV BL,[0000]	MOV AH,8
MOV DI,BX	XOR BH,BH
ADD DI,81	INT 10
MOV AL,24	MOV BH,AH
STOSB	XOR CX,CX
MOV DX,SI	MOV DX,184F
MOV AH,9	MOV AX,600
INT 21	INT 10
MOV DL,7	XOR BH,BH
MOV AH,2	XOR DX,DX
INT 21	MOV AH,2
MOV AH,8	INT 10
INT 21	POP AX
CMP AL,D	MOV AH,4C
JNZ 136	INT 21
MOV AL,2B	
MOV DL,AL	RCX
MOV SI,82	70
LODSB	W
CMP AL,D	Q

**Figure 1:** OPTION.SCR DEBUG script to create OPTION.COM. It is shown here in two columns, but JZ 126 should follow CMP AL,D when you type it in. Leave a blank line above RCX, and hit the Enter key after each line, especially the last one with the Q. Then put OPTION.SCR on the same disk with DEBUG.COM (version 2.0 or later) and type **DEBUG < OPTION.SCR**



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**■ USER-TO-USER**

```

100 ' Program for creating OPTION.COM -- by Edward Morris
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 7:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ S:IF S<>? THEN PRINT "ERROR IN LINE";B=16+169:END
140 T=S:NEXT:RESTORE
150 OPEN "OPTION.COM" AS #1 LEN=1:FIELD #1,1 AS D$
160 FOR B=1 TO 7:FOR C=1 TO 16:READ A$
170 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMM$:NEXT
180 CLOSE:PRINT "OPTION.COM CREATED"
190 DATA BE,82,08,89,F7,AC,3C,0D,74,1C,3C,2D,75,F5,B8,0D,1749
200 DATA AA,38,FF,8A,1E,88,08,89,DF,81,C7,81,08,08,24,AA,1968
210 DATA 89,F2,B4,09,CD,21,B2,07,B4,02,CD,21,B4,08,CD,21,1837
220 DATA 3C,0D,75,02,08,2B,88,C2,BE,82,06,AC,3C,0D,74,E6,1652
230 DATA 38,08,74,89,58,AC,3C,0D,58,74,03,EB,EE,AC,2C,38,1658
240 DATA 58,B4,08,38,FF,CD,18,88,E7,31,C9,B4,4F,18,B8,08,1882
250 DATA 86,CD,18,38,FF,31,D2,B4,02,CD,18,58,B4,4C,CD,21,1774

```

Figure 2: **OPTION.BAS** program to create **OPTION.COM** **ERRORLEVEL** setter.

characters, and loops back for another key. To get rid of these beeps, put **OPTION.COM** on the same disk as **DEBUG** and type

```

DEBUG OPTION.COM
E 12A 98 98
W
Q

```

When **OPTION** detects a legal key-press, it clears the screen and puts the cursor in the upper-left-hand corner. If you'd rather have it display the key and move the cursor to the next line down, type in the following **DEBUG** script using a pure-ASCII word processor or the **DOS COPY CON** command, and call the file **PATCH**.

```

E151 B4 02 CD 21 B2 0D CD 21 B2
E15A 8A CD 21 58 B4 4C CD 21
RCX
62
W
Q

```

Then get into **DOS** and type

```
DEBUG OPTION.COM < PATCH
```

Edward Morris  
Delavan, Illinois

Most **ERRORLEVEL** generators are rigid and inflexible and force you to use slightly different **.COM** programs for each set of tests. **OPTION.COM** lets you use one all-purpose program with different arguments in all your batch files. And it not only lets you print a customized prompt but gives

you choices about whether or not to beep and clear the screen. All this in 112 bytes.

Be careful in using some of the ASCII characters above 9, however, since **DOS** will try to execute some—such as > redirection symbols.

**TIME FOR A CHANGE**

It sometimes change the **DOS** time and date when using a batch file to reset the time and date stamps on directory entries (**User-to-User**, *PC Magazine*, April 29, 1986).

**■ IBM and Microsoft**  
fixed **DATE** and **TIME**  
commands in **DOS 3.3** to  
reset the **CMOS** clock.

With an aftermarket clock/calendar installed in a **PC** or **XT** (or compatible), it's simple to have the batch file end with a command, such as **PWRUPCLK** or **AST-CLOCK**, to set the time.

However, the **IBM PC AT BIOS** uses its **CMOS** real-time clock to initialize the **DOS** time and date automatically each time you boot up. To avoid having to re-boot or enter **TIME** and **DATE** by hand, I wrote **GETCLOCK.COM**, which uses the **AT BIOS** functions to read the **CMOS** clock and **DOS** functions to set the **DOS**



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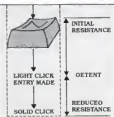
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## ■ USER-TO-USER

```

M GETCLOCK.COM
A 100
MOV AX,2          ;Get realtime clock time
INT 1A            ; AT BIOS function
CALL 125          ;CALL BCD2HEX routine
XCHG DX,DX        ;Set 1/100 seconds to zero
MOV AX,20         ;Set time
INT 21            ; DOS Function
MOV AX,4          ;Get realtime clock date
INT 1A            ; AT BIOS function
CALL 125          ;CALL BCD2HEX routine
XOR AL,AL         ;Remove cents and units years
XCHG AL,AX        ;Move century to AL
MOV CH,64         ;Convert century to
MUL CH            ; years, and after
XOR CH,CH         ; zeroing century,
ADD CX,AX         ; add back into years
MOV AX,2H         ;Set date
INT 21            ; DOS Function
RET              ;Near return to DOS
PUSH CX           ;125;BCD2HEX converts CX, DX from BCD to hex
MOV AX,DX         ;Convert DX first
CALL 12E          ;Perform first conversion
MOV DX,AX         ;Return answer to DX
POP AX            ;Get CX from stack into work register AX
XOR BX,BX         ;12;fall thru 2nd conversion instead of call
MOV CX,4          ;Set CH=0, CL=4 for bit manipulation
XCHG AX,CH        ;2 XCHG's results: 00 in AX,AX in AL,AL in CH
XCHG AL,CH        ;Move AL and work on AX
XOR AX,CL         ;Put tens in AL, units in AX
XCHG AX,SH        ;Shift units into low bits of AX
MOV CL,A          ;Move decimal 10 into CL
MUL CL            ; for conversion
ADD AX,tens       ;Add units to tens
XCHG AX,CH        ;Save result, and work on old AL
XOR AX,AX         ;Clear AX
MOV CL,4          ;Set CL=4 for bit manipulation
XOR AX,CL         ;Put tens in AL, units in AX
XCHG AX,CL        ;Shift units into low bits of AX
XCHG AX,HL        ;Save units and clear AX
MOV CL,A          ;Move decimal 10 into CL
MUL CL            ; for conversion
ADD AX,tens       ;Add units to tens
MOV AX,CH         ;Fall result in AX
XOR CX            ; end CX
;Next line is blank

```

**Figure 3:** GETCLOCK.SCR to create GETCLOCK.COM for ATs using DOS 3.2 or lower. Use a pure-ASCII word processor to type it in. Leave a blank line above RCX and hit the Enter key after each line, especially the last one. Then put it and DEBUG on your disk and type DEBUG < GETCLOCK.SCR

# 50 DESKTOP ORGANIZERS.





## ■ USER-TO-USER

```

100 ' Program to create GETCLOCK.COM -- by Michael J. Vanek
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 6:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ S:IF S<>T THEN PRINT "ERROR IN LINE";B*10+100:END
140 T=0:NEXTRESTORE
150 OPEN "GETCLOCK.COM" AS #1 LEN=1:FIELD #1,1 AS D$
160 FOR B=1 TO 6:FOR C=1 TO 16:READ A$
170 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMYS:NEXT
180 CLOSE:PRINT "GETCLOCK.COM CREATED"
190 DATA B4,02,CD,1A,E8,1E,00,30,D2,B4,2D,CD,21,B4,04,CD,1785
200 DATA 1A,E8,11,00,30,C0,86,C4,B5,64,F6,E5,30,ED,01,C1,2080
210 DATA B4,2B,CD,21,C3,51,89,D0,E8,03,00,89,C2,58,31,DB,2004
220 DATA B9,04,00,86,E5,86,C5,D3,C0,D2,EC,86,E7,B1,0A,F6,2538
230 DATA E1,00,F8,86,C5,30,E4,B1,04,D3,C8,D2,EC,86,E3,B1,2656
240 DATA 0A,F6,E1,00,D8,88,EC,88,C1,C3,00,00,00,00,00,1593

```

Figure 4: BASIC GETCLOCK.BAS program to create GETCLOCK.COM for ATs using DOS 3.2 or lower.

clock. The process was complicated, since the real-time CMOS clock and the DOS clock store their values in different formats, BCD (binary coded decimal) and

hexadecimal, respectively.

Use a pure-ASCII word processor to type in the GETCLOCK.SCR file in Figure 3, then put this file and DEBUG on

your disk and type DEBUG < GETCLOCK.SCR to create GETCLOCK.COM. Omit the comments after the semicolons and the semicolons themselves, leave a blank line above RCX, and be sure to hit the Enter key after each line, especially the last one. Or run the GETCLOCK.BAS program in Figure 4. Then, whenever you want to reset the date and time maintained in the CMOS clock, just type GETCLOCK.

Michael J. Vanek  
Ypsilanti, Michigan

*This does save steps in DOS. Versions 3.0, 3.1, and 3.2. But IBM and Microsoft fixed the DATE and TIME commands in DOS 3.3 to reset the CMOS clock. (Under earlier versions, you had to run the Diagnostics program to do this.) So running GETCLOCK under any version later than 3.2 won't change anything—one more reason to upgrade to DOS 3.3 or 3.31.*

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## ■ USER-TO-USER

## FREE CALCULATOR

I often need to make quick calculations, and it's annoying to have to load BASIC each time. The following CALC.BAT batch file makes it easy (be sure to type it all on one line, with a single space separating the %7 and %8):

```
ECHO %7 CHR$(%8): %1 %2 %3 %4 %5 %6 %7
%8 %9 : SYSTEM | BASIC | FIND %7
```

Since CALC.BAT pipes data into and out of BASIC, you can use all the normal BASIC functions. So type CALC (5.1-2) \*3 + SIN(2.8) to do some quick arithmetic, CALC ASC("Z") to find the ASCII code of Z, CALC HEX\$(123) and CALC &H7B to convert decimal numbers to hex and back, or even CALC HEX\$(NOT &HB7C3 or &H1A00) to compute Boolean expressions.

Be careful not to use more than eight spaces in anything you type, since the spaces are used to separate the nine command line replaceable parameters.

Martin Rayrole  
Pittsford, New York

*This works like a charm on any hard disk system with BASIC.COM in a subdirectory that your PATH knows about. You can adapt it to do all sorts of things. For instance, if you want to maintain a log file of boot-up dates and times (without any of the DOS "Current date is . . ." messages), you could insert a*

```
ECHO %7 DATE,TIME% : SYSTEM | BASIC |
FIND /V %7 %8 LOG
```

line in your AUTOEXEC.BAT file (once again, be sure to type it all on one line, with a single space separating the pipe symbol and the FIND).

Obviously, if you're using a non-IBM system, substitute the name of your BASIC (e.g., GWBASIC) in the examples above.

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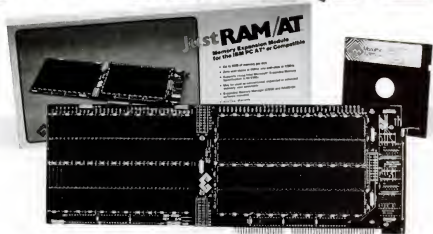
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■ EDITED BY CRAIG L. STARK

# POWER USER



*Moving light-bar menus for dBASE III Plus; hiding outlines in Word; printing hand-fed documents without leaving the current screen in WordPerfect; making WP number lists.*

## NUMLIST

Here's a way to create a list of sequential numbers (1 to *n*) in WordPerfect without resorting to an external program. Create a macro that simply enters a paragraph number and a carriage return, e.g.,

```
<ctrl-F10>  Begin macro definition
<Alt-N>      Call it Alt-N (for Number)
<Alt-F5>2    Select paragraph number
<CR>         Confirm automatic numbering
<CR>         Enter a carriage return
<ctrl-F10>   End macro definition
```

To create numbers, you just hit Esc, type in how many numbers you want, and press Alt-N. Reveal Codes will show each as [Par#:Auto].

Define the format of the numbers next; place the definition above the column of hidden [Par#:Auto] characters. You can define Arabic or Roman numerals, periods or no punctuation, and so forth. The defining process in WP 4.2 uses Mark Text, 6 (Other Options), 1 (Define Paragraph Numbering).

Saving the file using Text In/Out will now preserve the numbers as such, not the [Par#:Auto] codes. If the saved file contains nothing but these numbers, you can retrieve it into any document that needs a list of numbers.

For long lists of numbers, this procedure can save considerable time over typing the numbers one by one.

Collier N. Smith  
Longmont, Colorado

*I modified Mr. Smith's original idea to take advantage of WordPerfect's repeat feature, using the Esc key. To use this feature, you press Esc, type a number, and*

*then hit a repeatable key. Keys that repeat include the arrow keys, Alt-key macros, and any alphabetic key.*

—Neil J. Rubenking

## PRINTGO

Figure 1 contains a simple and effective macro for printing multipage documents on a hand-fed printer while continuing to edit another WordPerfect document. In normal operation, you'd have to leave the current screen and issue a "GO" to the printer after the paper is in place, thus:

```
<Shift-F7>4G<CR>
```

My suggested macro lets you keep the current document on-screen and simply press <Alt-G>.

Marion Finkler  
New York, New York

*It's certainly easier to hit Alt-G than it is to go into the printer control screen. However, you want to be quite sure to hit it only when the next page is already in the printer and ready. If your printer has a good-sized buffer, the beep signaling the next page will come long before it's actually time to change. Don't just hit Alt-G when you hear the beep; wait until the new page is ready.*—Neil J. Rubenking

```
<Ctrl-F10>  Begin macro definition
<Alt-G>      Call it Alt-G
<Shift-F7>4  Go to printer control menu
G<CR>        Give a "G" for GO and leave the menu
<Ctrl-F10>   End macro definition
```

Figure 1: A WordPerfect macro that simplifies editing while printing.

## DBASE III PLUS MENU

Here is a simple "lite-bar" menu program (Figure 2) for dBASE III Plus that allows selection either by entering the first letter of the desired choice or by positioning the cursor and hitting the Enter key. dBASE III Plus's macro capability, coupled with its INKEY() function, are the keys to this approach.

Doug L. Brisbin  
Shinnston, West Virginia

*Mr. Brisbin's implementation of the "moving light-bar" menu is especially flexible, as it lets you set the row, col, m\_line, and cmult variables to position and space the menu as desired on the screen. To make the program even more generic, I added changing prompt messages, response to the Esc key, and a trap to ignore unprogrammed keystrokes (e.g., PgDn) whose INKEY() values fall below 65 or above 122. Interestingly, you must SET ESCAPE OFF to make the Esc key work as the user would expect it to, that is, to escape from the menu and RETURN.*

*To change the spacing of LITE-BAR.PRg so it allows more menu choices, simply reduce the value of cmult and increase max\_ans.*

*If you need room for still more choices,*



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## ■ POWER USER

```
*** LITERAB.FRG for dBASE III Plus
SET TALK OFF
DO WHILE .T.  ** Main LOOP
  CLEAR
  SET ECHO OFF
  ROW = 1
  M_line=24  ** Menu Row()
  COL = 1    ** Cur choice COL()
  COUNT = 15 ** Column incrementer
  CTR = 1    ** Column positioner
  MAX_ams=4  ** Position controller

  ans 1 = "ADD"
  ans 2 = "EDIT"
  ans 3 = "PRINT"
  ans 4 = "QUIT"
  mens 1 = Append a new Record'
  mens 2 = Modify this Record'
  mens 3 = Print this Record'
  mens 4 = Exit from this Menu'

  @ ROW+1,2 TO ROW+1,78 DOUBLE
  @ ROW,COL+1:COUNT SAY ans 1
  @ ROW,COL+2:COUNT SAY ans 2
  @ ROW,COL+3:COUNT SAY ans 3
  @ ROW,COL+4:COUNT SAY ans 4

  DO WHILE .T.  ** MENU LOOP
    INDE=STR(CTR,1)  ** User choice
    @ ROW,COL+CTR:COUNT GET ans_sindx
    @ M_line,38 SAY mens_sindx
    CLEAR GETS
    key = #
    DO WHILE key = #
      key = INKEY()
    ENDDO

    @ M_line,38 ** Clear Message
    DO CASE
      CASE STR(key,2) = "4,24,5,19"
        * BL/DO/Lit/Up arrows
        @ ROW,COL+CTR:COUNT SAY ans_sindx
        CTR=CTR+1IF(STR(key,2) = "4,24",1,-1)
        CTR=IF(CTR>MAX_ams,1,CTR)
        CTR=IF(CTR<1,MAX_ams,CTR)
        INDE=STR(CTR,1)
        CASE key=1
          INDE=STR(ans_sindx,1,1)
          EXIT
        CASE STR(key,2) = "17,27"
          ** <ESC>page
          INDE="0"
          EXIT
        CASE key=65 OR key=122  ** Junk
          * Ignore
        CASE STR(key) = "A-Z" OR key=96
          ** Choice
          key=IF(key>96,key-32,key)
          INDE=STR(key)
          EXIT
        ENDCASE
      ENDDO
      SET ESCAPE ON

      DO CASE
        CASE INDE="A"
          * "DO Append routine"
          CASE INDE="E"
            * "DO Edit routine"
          CASE INDE="P"
            * "DO Print routine"
          CASE INDE="Q"
            * "DO Quit routine"
          EXIT
        ENDCASE
      WAIT
      ENDDO  ** 1
```

Figure 2: A moving light-bar menu technique for dBASE III Plus, complete with changing prompt line.

additional row(s) can be added as follows. First, decrease the value of row and draw the bottom of the DOUBLE box one ROW() lower. Next, recalculate the value of row each time in relation to ctr. For ex-

ample, to create a 5 by 2 stack of ten menu choices, the two "(a row)" statements inside the Menu LOOP must begin with

@ IIF(CTR<6,ROW,ROW+1)

Unfortunately, this excellent menuing system depends on the INKEY() function, and so cannot be used with dBASE II or III. Clipper and FoxBASE Plus users can rejoice in the simplicity and speed of their built-in MENU TO capability. I'll be amazed if dBASE IV doesn't include this too.—Brad Stark

## DEFAULT DILEMMA

I use WordPerfect both as a programming and text editor. Each function requires radically different default settings. Initially, I ran macros to alter the defaults for the task at hand, but I was frustrated by having to run a macro every time I started a new document or program. I also came to prefer programming in the EGA 43-line mode, but I still wanted the 25-line mode for other text operations. Unfortunately, the screen lines function is only available through WordPerfect's setup option (WP/S), so you can't access it in a macro.

WordPerfect retains its various default conditions, as well as color settings and Ctrl/Alt-key definitions, in the {WP}SYS.FIL file. To save these values, you simply copy (not rename) {WP}SYS.FIL to another filename. I have used {WP}SYS.25 and {WP}SYS.43 for my 25- and 43-line modes. You can repeat the process for as many default setups as you need.

Later, to utilize a particular default setup, you just copy the appropriate customized file back to {WP}SYS.FIL before starting WordPerfect. For instance, my batch file to start in the 43-line mode reads as follows:

ECHO OFF

CLS

EGA43

EGACOLOR 88 38

COPY {WP}SYS.43 {WP}SYS.FIL  
WP/R/M-RULER43.MAC

The other lines in the batch file switch the EGA into the 43-line mode, set the background color (programs courtesy of PC Magazine), and start WordPerfect with a macro that provides a ruler line at the bottom of the 43-line screen.



You can also use this method to provide personalized versions of the program for multiple users. It slows program loading a bit, but it is preferable to keeping multiple copies of *WordPerfect* in separate subdirectories.

Bruce V. Templeton  
Elko, Nevada

*If you share a WP system with other users who have different preferences, adopting this system will let each person use WP exactly as he wants to.*—Neil J. Rubenking

#### HIDDEN OUTLINES IN WORD

The combination of *Word*'s outline feature and its hidden text feature is ideal for those who use outlines but who don't want their level headings or notes as part of their final document.

The trick is to write all level headings and outline notes in hidden text, then toggle the hidden text on and off using the Esc Window Options "Show Hidden Text" command. This lets you work from an outline and notes on-screen, then hide all unwanted text instantly by toggling "Show Hidden Text" to off, leaving only the document in view. If you use a macro program with *Word*, you can even toggle the outline text to show or not to show with a single keystroke.

Another benefit of using hidden text for writing the outline is that *Word* shows hidden text differently from regular text—underlining it in graphics mode, and using a different color in text mode. This keeps the outline clearly visible even in document mode, in which *Word* doesn't indent the level headings as in outline mode.

Bob Brody  
Los Angeles, California

*Another thing you might keep in mind is that you can show the same document in two windows simultaneously, showing hidden text in one window but not the other. This technique will let you see your document complete with outline and notes in one window, while you see only the document in the other window. This can be helpful if you want to see your notes or outline but find that they are cluttering up the screen, making it difficult to read the document on-screen for continuity.*

—M. David Stone

#### WHAT'S IN A NAME

When you tell it to SAVE a file (F10), *WordPerfect* displays the old filename and allows you to change it, e.g., "Document to be saved: A:\SUBDIR\FILENAME.EXT". Then, if the specified file exists, you get the message, "Replace A:\SUBDIR\FILENAME.EXT? (Y/N)".

When working quickly, I occasionally don't hit the Enter key hard enough to register, so the "Y" intended to answer the second prompt becomes the first letter of a new filename, and the old filename disappears. After canceling the command with F1 and trying again, I get the message "Document to be saved: Y:\SUBDIR\FILENAME.EXT". Even though I canceled the command, the filename associated with that document got changed. The same kind of thing could happen if you start to type in a new filename, then change your mind and cancel.

One obvious fix is to retype the entire pathname, but this is often inconveniently long. A simpler solution is to SAVE (F10) again, type the correct first letter, and then CANCEL (F1) again. SAVE (F10) yet once more, and you'll find that the stored filename has been corrected.

Alan D. Legatt  
White Plains, New York

*This tip only relates to WordPerfect, Version 4.1 and earlier. The problem was fixed in Version 4.2, and it would be smart to upgrade. While you wait for it to arrive, however, this hint will be handy. WordPerfect Corp. is continually reworking the program to eliminate such bugs. If you have a version of WordPerfect with a recognized bug, you can get your WordPerfect disk replaced free. Call WordPerfect's order desk at (800) 321-4566 to arrange it.*—Neil J. Rubenking

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■ EDITED BY ROBERT L. HUMMEL

# LANGUAGES



*A program that converts a byte into a string of binary bits; keeping a record of backups in C; a BASIC delay routine; and a Turbo Pascal error handler that helps locate bugs.*

## BASIC

### A BETTER PAUSE

In his PC Lab Notes on QuickBASIC and Turbo Basic, Ethan Winer suggested that delay routines should be written:

```
x = Timer
While Timer < x + Seconds
Wend
```

Unfortunately, that approach could give the unwary programmer a very long wait if it is executed within the specified number of seconds before midnight. Though it is slightly more complicated, the delay routine shown in Figure 1 is accurate to within .1 second and will never hang the system.

Jim Hahn  
Crete, Illinois

*Boy, some people sure are fussy. But you're right—once in about a zillion years some poor soul will sit there staring at a blank screen, keyboard apparently locked, wondering what happened. This routine does the trick.—Ethan Winer*

```
Sub Delay(T!)
D1 = Timer + T!
If D1 > 86399.9 Then
  D1 = D1 - 86400
  While Timer > 1 : Wend
End If
While Timer < D1 : Wend
End Sub
```

Figure 1: A QuickBASIC subprogram to create a pause of a specified number of seconds.

## C

### STAMPING SUBDIRECTORIES

When backing up files on my hard disk, I need to be able to tell at a glance when I last backed up. I wrote the program LAST.EXE to automatically create a zero-byte file whose name is the date of the last back-

up. The file extension is ".@.@@" to make it easy to see in a directory listing. By including LAST in the batch file I use for making backups of a subdirectory, the file is always up to date.

LAST.C, in Figure 2, was written for DeSmet C 2.51, but it's simple enough that it could be modified and recompiled

```
/* last.c - 03/08/87
   To compile:
   cc88 last
   bind last
*/
main()
{
  char last[9];

  dates( last ); /* get the date in MM-DD-YY format */
  strcat( last, ".@@" ); /* add ".@@" to it */

  /* make sure it begins with a zero if less than 10 */
  if ( last[0] == ' ' )
    last[0] = '0';

  creat( last ); /* create a file using MM-DD-YY.@@" */
  exit(0);
}
```

Figure 2: The DeSmet version of LAST.C, which date-stamps directories.

```
: backup.bat - 03/08/87
: backs up the current directory on c: to a:
erase *.bak
erase *.*
: insert the commands for your favorite backup program here
backup *.* a:
last
: end of last.bat
```

Figure 3: A sample batch file showing how LAST.EXE might be used.



## ■ LANGUAGES

```

/* mlast.c
   To compile with Microsoft C 5.0
       cl last.c
   To compile with QuickC:
       cl /qc last.c
*/
#include<aya\types.h>
#include<aya\stat.h>
#include<dos.h>
#define ERROR -1

main()
{
    struct doadata_t DATE;
    char last[13];
    int file;

    _dos_getdata(4DATE);          /* call DOS for system data */
                                /* put data in format */

    sprintf(last, "%02d-%02d-%02d", DATE.month, DATE.day, DATE.year-1988);

    strcat( last, ".000" );        /* tack on file extension */

                                /* create the file */
    if((file = creat( last, S_IWRITE)) == ERROR)
        printf("\nError creating dataatamp file");
    else
        close(file);
    exit(0);
}

```

Figure 4: A version of LAST.C for the Microsoft compilers.

with almost any C compiler. The batch file in Figure 3 shows how LAST.EXE is used in my backup procedure.

McI Tearle  
Phoenix, Arizona

*This is a fine example of a simple C program that cleverly handles a useful task. It creates a 0-terminated string containing the DOS system date. Then the filename extension, ".@.@@", is concatenated to make a DOS filename. The C library*

*creat() function generates the directory entry. Since no characters are written to the file before it is closed, it has a length of 0. Figure 4 contains a listing for LAST to be used with the Microsoft C 5.0 and QuickC compilers.*—Richard Hale Shaw

## TURBO PASCAL

### BINARY

The program in Figure 5 demonstrates a routine to convert a byte into a string of bi-

nary digits. It also demonstrates a general programming technique you can use in other circumstances. In order to test whether each digit should be 0 or 1, we have to compare the byte with successive powers of 2. If the arithmetic AND of the byte and the power is nonzero, that digit is a 1. It's not difficult to calculate a power of 2 using the SHL function—2 to the n power is (1 SHL n). However, since we're concerned with eight particular powers, a simple table lookup is faster. The array called Power2 directly relates the eight digits of the binary string with their corresponding power of 2. In general, you'll gain speed if you can replace a calculation with a table lookup.—Neil J. Rubenking

### FILLING A STRING

You will often need to fill up a string to a certain length with one character. If you need a string of five spaces, you might use a constant:

```
STRING_A := '      ';
```

But when you need 50 spaces, you must count them carefully. I use the Turbo Pascal function FILLCHAR and construct the simple function FillString (Figure 6) to do the job. The syntax is very simple:

```
STRING_A := FillString(50, ' ');
```

This returns a string of length 50 filled with spaces.

Francis Chen  
Ottawa, Ontario  
Canada

*Note that the call to FillChar inserts one more copy of the character than seems*

```

{$R+,C-}
PROGRAM BinaryDemo;
TYPE
    Bstring = STRING[16];
VAR
    I : Integer;
FUNCTION binary(S : Byte) : Bstring;
VAR
    P : Byte;
    Temp : Bstring;
CONST
    Power2 : ARRAY[1..8] OF Byte = (128,64,32,16,8,4,2,1);
BEGIN
    Temp := '#####';
    FOR P := 1 TO 8 DO

```

```

        IF (S AND Power2[P]) <> 0 THEN Temp[P] := '1';
    END;
    Temp := Temp;
FUNCTION aInteger(I : Integer) : Bstring;
BEGIN
    aInteger := binary(Hi(I)) + aInteger(Lo(I));
END;
BEGIN
    REPEAT
        Write('Enter an integer, 0 to quit:');
        ReadLn(I);
        WriteLn(I, ' in binary is ', aInteger(I));
    UNTIL I = 0;
END.

```

Figure 5: A routine to print numbers in binary.



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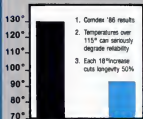


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## ■ LANGUAGES

```

(SR,C-)
PROGRAM DEMO_FILL_STRING;
CONST
  MaxLength = 255;
TYPE
  Line = STRING(MaxLength);

FUNCTION FillString(St_Length : Integer; Ch : Char) : Line;
(-----)
( Fill a string of length up to MaxLength with the char )
( variable Ch. If the length is too long, truncate to )
( MaxLength. If too short, return an empty string. )
(-----)
VAR
  TempString : Line;
BEGIN
  IF St_Length IN [1..MaxLength] THEN
    BEGIN
      FillChar(TempString, St_Length+1, Ch);

      TempString[0] := Chr(St_Length);
      FillString := TempString;
    END
  ELSE
    IF St_Length > MaxLength THEN
      FillString := FillString(MaxLength, Ch)
    ELSE
      FillString := '';
    END;
END;

BEGIN
  WriteLn('58 spaces ', FillString(58, ' ');
  WriteLn('More than 255 of chr(248) ', FillString(278, Chr(248));
  WriteLn('Concatenation Demo: ' + FillString(28, ' '));
  WriteLn('Less than 0 of 'w' ', FillString(-28, 'w');
END.

```

Figure 6: A program that creates a string of many repetitions of one character.

necessary. It fills *St\_Length + 1* bytes rather than just *St\_Length*. That's because the very first byte of any string contains the current length of that string. Another way to fill just the "text" portion of the string variable would be

```
FillChar(TempString[1], St_Length, Ch);
```

That is, fill starting at the first actual character of the string.—Neil J. Rubenking

**WALKBACK**

Locating Turbo Pascal runtime and I/O errors can be frustrating. Turbo Pascal provides only the address of the error in the source code, not the name of the routine in

which it occurred. I found it necessary to get more information about the location of the error. I created a simple walkback of the calls leading to the error message by replacing Turbo Pascal's internal error handler with my own (Figure 7).

The program keeps the name of the current routine, or any other pertinent label, at

```

(SR,C-)
PROGRAM ErrDemo;
( A demonstration of error walkback using a user supplied )
( error handler. By: David C. Hamlin )
TYPE
  Str28 = STRING(28);
CONST
  ProgDepth = 2;
( How deeply nested are your calls ? )
( Keep this as small a possible to save space )
VAR
  TopErr : Integer; (Points to top of ErrStack)
  ErrStack : ARRAY[0..ProgDepth] OF Str28;

PROCEDURE PushErr(Str1 : Str28);
( Put the Procedure name on the stack )
( Call right after the Begin is each procedure or function )
( and don't forget to call PopErr at the End )
BEGIN
  TopErr := TopErr+1;
  IF (TopErr > ProgDepth) THEN
    BEGIN
      TopErr := ProgDepth;
      ErrStack[TopErr] := 'ErrStack Overflow';
    END
  ELSE
    ErrStack[TopErr] := Str1;
  END;
END;

PROCEDURE PopErr;
( Take the Procedure name off the stack )
( Don't forget to call right before the )
( end of each procedure or function in )
( which you call PushErr )
BEGIN
  TopErr := TopErr-1;
  IF (TopErr < 0) THEN
    BEGIN
      TopErr := 0;
      ErrStack[0] := 'ErrStack Corrupted';
    END;
  END;
END;

PROCEDURE ErrHalt(ErrNum, ErrAddr : Integer);
( error handler to demonstrate the walkback )
VAR
  I, Row, Col : Integer;
BEGIN
  WriteLn('-----');
  CASE HI(ErrNum) OF
    0 : WriteLn('User Break ');
    1 : WriteLn('I/O Error $ ', Lo(ErrNum));
    2 : WriteLn('Run time Error $ ', Lo(ErrNum));
  END;
  Write('occurred at ADDRESS: ', ErrAddr);
  WriteLn(' is ROUTINE: ', ErrStack[TopErr]);
  WriteLn('Press <return> for Error Walkback: ');
  ReadLn;
  CLREX;
  GOTOXY(10, 5);
  Write('----- WALKBACK -----');
  Row := 6;
  Col := 3;
  FOR I := TopErr DOWNTO 0 DO
    BEGIN
      GOTOXY(Col, Row);
      Write(ErrStack[I]:28, ' ', I);
      Row := Row+1;
      IF (I = 24) THEN BEGIN
        Row := 6;
        Col := Col+24;
      END;
    END;
  WriteLn;
  Write('Execution halted. ');
  Halt;
  ( or Turbo will do it for us )
END;
END;

PROCEDURE UserTwo(Arg : Real);
BEGIN
  PushErr('UserTwo');
  WriteLn('Squares root of ', Arg, ' is ', Sqrt(Arg));
  ( this should produce an error if Arg is < 0 )
  PopErr;
END;
END;

PROCEDURE UserOne(Arg : Real);
BEGIN
  (continues)

```

Figure 7: A demonstration of tracing the program flow that led to an error with a user-supplied error handler.



## ■ LANGUAGES

```

PushErr('UserOne');
UserTwo(krg);
PopErr;
END;                                (UserOne)

BEGIN                                (ErrDemo)
{ Next Two Lines Initialize ErrStack }
TopErr := 0;

```

```

ErrStack[0] := 'Main Program';
{ Replace Turbo's Error Handler }
Errortr := ofs(ErrHalt);
{ Do something! }
UserOne(2); (OK)
UserOne(-1); (ERROR!)
END.                                { ErrDemo }

```

(Figure 7 ends)

the top of a stack and walks down the stack should an error occur. PushErr copies a string onto ErrStack and increments TopErr, if there is room. PopErr decrements TopErr. PushErr should be called right after the BEGIN of a routine, and PopErr should be called just before the END.

The error walkback is particularly useful in debugging overlaid programs. When a runtime or I/O error comes up, move the code for the offending routine so that it is the first in the overlay group. Turbo Pascal will then point to the correct location of the error the next time it occurs.

David C. Hamlin  
Hubbell, Michigan

*The program shown here will give you a map of the procedure calls that led up to an error. If you use it in a program distributed to others, you might add a line advising them to hit the PrtSc key for a hard-copy record of the problem.*

*The example program allows for an error stack of depth 2. If your program uses many nested procedure calls, you'll certainly have to raise this limit. Also, a recursive routine could easily overflow any stack size you set. If you do use the walk-back technique with a recursive routine, just pop the error stack before the recursive call and push it again afterward. For example, the commands*

```

PopErr;
RecursiveProc(N-1);
PushErr('RecursiveProc');

```

will accomplish this.—Neil J. Rubenking

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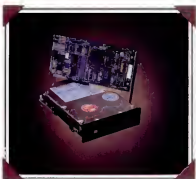
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# PC TUTOR

*C programs for dumping screens and dialing modems; SORTing out DOS temporary files; BASIC programs for auto-exiting to DOS and for generating hot and cold reboots.*



## LEAVING BASIC

Can you run a BASIC program and immediately return to DOS when it ends? If you enter `BASIC filename` at the DOS prompt the BASIC program will run, but when it finishes you are left in BASIC and have to type `SYSTEM` to return to DOS. I have used `SHELL`, but that is only a temporary exit.

Suann Lively  
Chicago, Illinois

When you're in the BASIC interpreter, the `SYSTEM` command, entered in the immediate mode, exits BASIC and returns you to the DOS prompt. Although it's more common to type this command in the immediate mode of the interpreter, it also works as part of a program. Thus, to have a program exit automatically, just make `SYSTEM` the last command to be executed in the program. Consider the short BASIC program in Figure 1. The user can choose from three options: `T` displays the time, `D` displays the date, and `X` terminates the program and returns to DOS.

`SHELL`, as you note, causes a secondary copy of `COMMAND.COM` to be loaded and given control. This gives a temporary exit to the DOS prompt while leaving BASIC loaded. To return to BASIC, the `EXIT` command is used.

```
10 PRINT "Enter T,D, or X":INPUT AS
20 IF AS="T" THEN PRINT TIME$
30 IF AS="D" THEN PRINT DATE$
40 IF AS="X" THEN SYSTEM
50 GOTO 10
```

Figure 1: A BASIC program illustrating how to return to DOS automatically.

## SCREEN DUMPS IN C

I am currently attempting to send an image of the active graphics screen to a dot matrix printer from within a Microsoft C program. The `Shift-PrtSc` key combination works just fine, but I would like to automate the process so the user doesn't have to press any keys at all. Although I am comfortable using software interrupts, I do not know assembler. Is there a straightforward way, from within the C program, to simulate the `Shift-PrtSc` combination?

Mark Petrovic  
Stillwater, Oklahoma

Over the years, this has remained one of the most-asked questions. While we have shown examples of how to generate a screen dump from BASIC, assembler, and Pascal, I don't believe we've done so for C. The time has come to correct this oversight. Fortunately, most C compilers make it easy by providing direct access to most

PC interrupts using the `int86` function. A program in C that generates the `Print Screen` interrupt directly and has only one executable line is shown here.

```
#include <dos.h>
main()
{
    union REGS registers ;
    int86(5,&registers,&registers) ;
}
```

When the `Shift-PrtSc` key combination is struck, the BIOS keyboard handler intercepts it and generates a software `Int 5`. The interrupt passes control to the print-screen routine, which is usually located in ROM. The screen is printed and control passes back to the original program, which resumes operation where it was interrupted.

To simulate this process, a call is made to the `int86` function, which takes three arguments. The first argument, an integer, is the number of the interrupt to invoke. The next two arguments are unions that approximate the register architecture of the 8088 processor. Both DOS and BIOS interrupts normally pass arguments and return values through registers. This method is fast, efficient, and difficult to do in high-level languages. The C program manipulates a copy of the registers as defined by the `REGS` union. Before the selected interrupt is invoked, the values in the union are copied to the actual CPU registers. When the interrupt is finished, the registers are copied to the union specified in the third argument. While interrupt 5 takes no arguments, the `REGS` structure was included to satisfy the requirements of the function.

■ While we have shown how to generate a screen dump from BASIC, assembler, and Pascal, we haven't for C. It's time to correct this.



## ■ PC TUTOR

```
#include <stdio.h>

main()
{
    FILE    *modem ;

    if( (modem = fopen("COM2","wb")) == NULL)
    {
        printf("Error accessing modem\n") ;
        exit() ;
    }

    fprintf(modem, "ATDT5551212\x0D" ) ;
    fclose(modem) ;
}
```

Figure 2: A C program that sends a dial command to a modem.

### DIALING PHONES WITH C

I was experimenting with the Kermit communications protocol recently and needed a small, fast program in C to dial through my modem. I have read a little about redirection of input and output, but I haven't been able to find any examples about redirecting to a modem. Somehow, I feel there must be an easier way to access COM1 and COM2 from inside C than by using redirection.

Koay Kok Keong  
Iowa City, Iowa

There is an easier way. All "devices" on a PC, including CON, NUL, COMx, PRN, and LPTx, can be treated like files for most operations. That is, they can be opened, written to, read from, and closed. The short C program listed in Figure 2 shows how the Hayes command string to dial a number can be sent to the second serial port, COM2.

First, the variable *modem* is defined to be of type "pointer to FILE." Next, a call is made to open the device COM2. Actually, C neither knows nor cares whether COM2 is a filename or a device. That determination is made by DOS when it is called by the C function *fopen*. The *wb* argument instructs *fopen* to access the file for writing in binary mode. In binary mode, no translation is done on the characters, and they are passed directly to the device.

If no error (for example, having no COM2 in the system) is encountered, the

string needed to cause the modem to dial is simply printed to the serial port, COM2. The trailing *\x0D* is simply a carriage return. The program can, of course, be modified for different COM ports to suit your needs.

### DOS REDIRECTION

When I issue the command *DIR | SORT*, the numbers 00083104 and 00083219 appear as two of the files. What do these two numbers represent, and why do I only see them whenever I ask for a sorted directory output?

Gerald McFarland  
Memphis, Tennessee

DOS provides five standard input and output devices. They are called standard input, output, error, auxiliary, and printer. DOS also provides the option of "redirecting" these devices. By redirecting standard input and output, a program can be made to receive its input from a source other than the keyboard or to direct its output somewhere besides the screen. This substitution is completely transparent to the executing program.

The three symbols used to implement this facility on the DOS command line are *<*, *>*, and *|*. For example, typing in the command

*DIR > TEMP.DAT*

causes the directory listing that would normally be displayed on the screen to be written to a disk file named *TEMP.DAT* in-

stead. Similarly, the command

*SORT < TEMP.DAT*

causes the input to the *SORT* program, which would normally come from standard input, to be taken instead from the disk file *TEMP.DAT*. It's easy to get the symbols confused, so to help me remember, I think of the symbol as pointing in the direction of data flow.

Rather than having to create and erase the file *TEMP.DAT* explicitly each time we want a sorted directory, we'd really like to take a shortcut and say

*DIR >< SORT*

What we want is to have the output of the *DIR* command feed directly into the input of the *SORT* command without any intervention from us. Trying to execute this shortcut command will produce an error, however. But DOS provides just the function we need with the pipe operator, *|*.

When we execute

*DIR | SORT*

DOS creates a temporary file to hold the information normally sent to standard output by the *DIR* command. The *SORT* program is then executed with standard input redirected to read from the temporary file, just as we did manually with *TEMP.DAT*. The difference is that DOS will automatically delete the temporary files when it is done.

The strange filenames you see in the sorted directory listing are temporary files that DOS created while it was "piping" the output of the *DIR* command into the input of the *SORT* command.

The reason these files appear in the directory listing is that they are created before the *DIR* command is executed so the output will have somewhere to go. But you won't find them in the directory after the sorted list is displayed because the files are automatically deleted.

The files have strange names because each name is created from a nonsense number, such as the current time of day or the number of timer ticks in low memory. Running *DIR | SORT* several times in succession should produce filenames that vary slightly from each other.

There's one curious point I must leave unexplained. While we created just one



temporary file, DOS actually created two files. I executed the DIR | SORT command on a freshly formatted disk and then examined the deleted files with a sector-read program. One file contained the output from the DIR command, but the second was empty and had never been used.

#### REBOOTING WITH BASIC

How can I force a system reboot from inside the BASIC interpreter? I'd like to use it to reboot the system at the end of a batch file that installs a RAMdisk.

Edward G. Schwartz  
APO, New York

PC Tutor, June 23, 1987, gave instructions for using DEBUG to create two short .COM files to perform either a "warm" or "cold" reboot of the computer. For batch files, using these would be faster than loading the BASIC interpreter.

There may be some legitimate reasons for wanting to perform a system reset from inside a BASIC program, however. The following instructions give a BASIC program the ability to "warm-boot" the computer, bypassing the memory check.

```
10 REM Warm Boot
20 DEF SEG = &H40
30 POKE &H72,&H34
40 POKE &H73,&H12
50 DEF SEG = &HFFFF
60 RB = 0
70 CALL RB
```

To do a "cold" boot, forcing a recount of system memory and simulating a power on/off cycle, change the following two lines:

```
30 POKE &H72,0
40 POKE &H73,0
```

#### ASK THE PC TUTOR

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■ FRANK J. DERFLER, JR.

# CONNECTIVITY CLINIC



*Fighting capacitance under StarLAN; a program to make Novell network log-on procedures independent of LASTDRIVE; getting more hard disk storage under NetWare.*

## A NO-NO ON SHIELDED WIRE

We recently ran into problems installing Western Digital's StarLAN on shielded twisted-pair wiring. The distributed capacitance of the shield, tightly wrapped around the twisted pair, attenuates the high-frequency component of the signals. This can make it difficult for nodes to detect the rise and fall of signals over a long run of wire. The engineer we talked to at Western Digital suggested using conduit to run cable through electrically noisy areas. Conduit has a lower distributed capacitance and less attenuation.

George Mallard  
The Woodlands, Texas

*Thank you for the information, Mr. Mallard. Before installing conduit, I would examine fiber-optic alternatives for areas with a lot of electrical noise. You can integrate standard StarLAN cards with Pure Data or Codenoll fiber cards running un-*

*der Banyan, Novell, or IBM networking software. I would rather polish the glass end of a fiber-optic connector for 15 minutes than bend aluminum tubing for days.*

## FINDING THE FIRST DRIVE

Workstations on our Novell network have different values in their CONFIG.SYS files for the LASTDRIVE parameter. This complicates network log-on. After a user loads the NetWare shell, the Login program, found on the first network disk, is run. This disk is usually F: but will vary with the choice of LASTDRIVE.

To make our network log-in procedures independent of LASTDRIVE, I wrote a small program, LASTDRIV.COM (see Figure 1), which makes the first network disk current. In this way the start-up batch files can always find Login.

LASTDRIV.COM satisfies another, less-common need. If a user logs out of his NetWare ID, the current network drive at

the time of the log-out becomes the network drive containing the Login program. If the user then changes the current drive to access a local device, he may have a hard time remembering where to find the Login program to establish a new network session. LASTDRIV.COM makes the correct drive current in this case, too.

Arthur Rothstein  
Morgan Laboratories  
San Francisco, California

*Mr. Rothstein's program is useful in certain installations, and it demonstrates how to test for the presence of the NetWare shell. Note the use of interrupt 21h. The comments describe what the code does.*

## MORE STORAGE UNDER NETWORK

Under Novell's NetWare, larger hard disk drives usually format to below their stated capacity. One reason is that NetWare is more picky than DOS about how much of

```

PAGE 255,132
TITLE Make the first network drive current
NAME LASTDRIV
COMMENT 0
If the Novell shell is loaded, make the first network drive the current drive.
The command line syntax is: LASTDRIV
Returns: 0 shell is loaded.
        1 shell is not loaded
0
CR EQU 13
EQI 14
CSEG SEGMENT PARA PUBLIC 'CODE'
ASSEMBLE CR+CSEG,DS+CS
ORG 100H
LASTDRIV PROC FAR
MOV AX,200H
INT 21H
TEST AL,AL
JE @SHELL
JMP @NO_SHELL
NO_SHELL:
MOV DX,AX
;get first network drive ID
INT 21H
;is the shell loaded?
JE @SHELL
;skip if no
;get drive ID in DL
NO_SHELL:
MOV AX,200H
INT 21H
;call Novell DOS shell
;save number of drives in BL
MOV AX,13H
;get current disk

INT 21H
CMP AL,DL
JE @SUCCESS
INC DL
;try the next drive
CMP DL,BL
JN @NO_SHELL
MOV DX,OFFSET MSG2
;get address of error message
JMP SHORT @ERRORIT

@SUCCESS:
MOV AX,0
;successful return code
EXIT:
MOV AX,6CH
INT 21H
;return to application
;call DOS, do not return

@SHELL:
MOV DX,OFFSET MSG1
;get address of error message
@ERRORIT:
MOV AX,9
;display message
INT 21H
;call DOS to display message
MOV AX,1
;error return code
JMP @EXIT
;go to centralized exit

LASTDRIV ENDP
MSG1 DB CR,LF,'Network shell is not loaded',CR,LF,'$'
MSG2 DB CR,LF,'Unable to find Login disk',CR,LF,'$'
CSEG ENDS
END LASTDRIV

```

Figure 1: LASTDRIV.COM is an assembly language program that makes the first drive encountered on the Novell network the current drive.



## ■ CONNECTIVITY CLINIC

the drive it can use when a drive type is specified in the Compsurf process.

For example, a Priam 130-megabyte drive, which has 15 heads and over 1,200 cylinders, can be used to almost its full

storage capacity under DOS when partitioned under a program such as *SpeedStor* and when listed under setup as a type 9—even though type 9 expects only 15 heads and 900 cylinders. Under *NetWare*,

## ■ Novell's conservative approach puts reliability ahead of squeezing out the last megabyte.

the same drive, when formatted by the Compsurf program as a type 9, will be reduced to 112 megabytes—a loss of nearly 20 megabytes. This storage can be reclaimed, however, if the PC file server has a BIOS that supports extended drive tables (such as the Phoenix BIOS, Version 2.01 and later). In this case, specifying the 130-megabyte Priam Drive as a type 42 (which expects 15 heads and 1,024 cylinders) will allow the use of over 127 megabytes.

Many other drives can also be more efficiently used by selecting the drive type supported under the file server's BIOS that has the number of heads and cylinders that most closely matches the hard disk drive manufacturer's specifications.

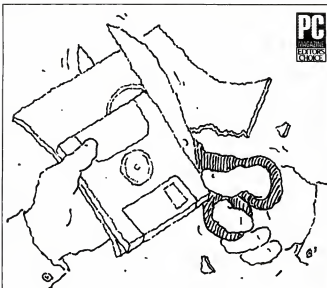
Bill Glockner  
San Diego, California

*Mr. Glockner's suggestion works, but remember that Novell's conservative approach puts reliability ahead of squeezing out the last megabyte. The reliability of hard disk drives has increased dramatically in the last 2 years, but you still might find circumstances in which crowding in a few megabytes leads to losses later.*

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\*Starch Study, July 1986



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• RGB IBM COMPATIBLE • 14" NON-GLARE SCREEN  
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- |         |             |      |           |       |
|---------|-------------|------|-----------|-------|
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| ST-238  | HALF HEIGHT | 30MB | 65ms (RL) | \$299 |
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| ST-277  | HALF HEIGHT | 60MB | 40ms (RL) | \$649 |
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- |                           |               |          |
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| 5 1/4" OS DD 360K         |               | \$69.95  |
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- |                                   |        |
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TRUE HERCULES COMPATIBILITY. SUPPORTS LOGIC 123  
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• 640 x 320 x 200 RESOLUTION, LIGHT PEN INTERFACES

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ALL THE FEATURES OF 8 PACK: AT HALF THE PRICE  
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**60 MB \$649**

Drives are Seagate models ST-251 (40 MB) &  
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FAST 40ms access time!

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INDICATOR  
• SOCKETS FOR 1 MB OF RAM AND 60287  
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• REPLACEMENT BOARD FOR RT STYLE CHASSIS  
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# NOW...Northgate Brings You the Industry's Highest Performance Systems at Industry-Low Prices!

## "ET"<sup>TM</sup> Enhanced Technology Complete Systems

**RLL HARD DRIVE ENCODING, 1:1 INTERLEAVING AND 2.5 TIMES FASTER DATA TRANSFER CONTROLLER = LIGHTNING FAST COMPUTING PERFORMANCE AT A PRICE OTHER COMPUTER VENDORS CAN'T MATCH!**

If you're a first-time computer shopper, looking at all the ads, you're probably plenty confused. BUT...YOU KNOW YOU JUST CAN'T BUY A FULL AT SYSTEM FOR \$995.00 OR AN XT FOR \$349.00 AS OTHERS ADVERTISE. THAT'S LIKE A CAR WITHOUT WHEELS.

Don't be misled by the confusing "bare bones" or "basic system" pricing others use just to appear competitive. By the time you add up everything else you need, you'll end up paying more and probably getting just an ordinary performance machine. Knowledgeable computer buyers know that Northgate offers **Complete Systems that are truly different from the rest of the pack.** That's why Computer Shopper named Northgate's 286 as the 1987 BEST BUY IN COMPUTING. Now, Northgate's innovative design skills have created "E/T" Enhanced Technology Systems with even better performance and value.

Our proven method of RLL encoding superb MiniScribe hard drives gives you 50% more hard drive storage for your money. A 1:1 interleave is applied to the drives. This delivers data from disk to the read-write heads 300 to 800% faster than the drive/controller combination most of our competitors provide.

Northgate uses an OEM hard drive controller with data transfer rates up to four times faster than most competition.

The result is a true Power System with overall system performance at least 2.5 times that of systems using ordinary, off-the-shelf parts.

Northgate has developed a thoroughly reliable method of using RLL encoding on the hard drives in all our 286 "E/T" systems. In 80286 systems, this technology is unknown to most of our competitors. Call them! You'll be amazed to find almost none offer RLL drives in 286 systems. Some will even tell you it can't be done. Next, ask about vital throughput factors like controller data transfer rates and interleaving ratios.

Most competitors merely assemble a collection of parts so archaic as to actually degrade performance. The Drive/Controller combinations most others use have the effect of **harnessing a race horse to a plow.** Processor speed is wasted because controller transfer time is so agonizingly slow.



Northgate takes the confusion, uncertainty and guesswork out of buying your computer. Skillfully assembled, thoroughly tested, your Northgate system arrives fully configured, ready to plug together and use. And Northgate has designed the most thorough, easy-to-follow documentation that takes novice or professional from set-up to shut down. WRITTEN IN ENGLISH!

We format and partition your hard drive to your specifications using advanced OnTrack Software which we even send with your system at no extra charge.

All these are the compelling reasons why Northgate Systems are used by: **Government Agencies**—FAA, EPA, DNR, USDO, INTERIOR, USDA, NPS; **Fortune 500 Corporations**—RCA, Westinghouse, Intel, General Dynamics, Bell Southern, Dow Chemical, Honeywell and many more; **Colleges and Universities**—So. Cal., Duke, Iowa State, N. Car., S. Car., Mo., Harvard and more, as well as **thousands of small businesses and individuals worldwide.**

Add to all these features, the most meaningful Consumer Protection Policies in the computer industry (see next page).

So forget competition's bare bones prices and those just ordinary systems... **COMPARISON WILL PROVE NORTHGATE OFFERS MORE!**

### STANDARD NORTHGATE SUPER/TURBO 286-60 "E/T" SPECIFICATIONS:

PROCESSOR	INTEL 80286
PROCESSOR SPEED	8/12 MHz 1 WAIT
MAKE OF BIOS	AWARD WSETUP
EXPANSION SLOTS	8 (TWO 8 BIT, SIX 16 BIT)
STANDARD MOTHERBOARD MEMORY	1 MEGABYTE
CO-PROCESSOR SLOT	2805
CLOCK-CALENDAR	YES
NO. OF FLOPPY DRIVES	YES WITH AA BATTERIES
(NOTE: 3 EXPOSED HALF HEIGHT DEVICES MAY BE INSTALLED)	
BRAND OF FLOPPY	FUJITSU
NO. OF HARD DRIVES	1 (SPACE FOR TWO)
TYPE OF HARD DRIVE	MINISCRIBE
HARD DRIVE FORMATTED	MODEL 3650
STD. MONITOR TYPE	64.2 MEGABYTES
STD. VIDEO CONTROLLER	USABLE
ADDITIONAL PORTS STANDARD	SAMSUNG 12"
KEYBOARD TYPE	AMBER TTL
MS-DOS 3.2 & GWBASIC	HERCULES
CASE—FULL SIZE (NOT BABY AT)	COMPAT 1 P.P.
	1 P.P. 1 S.P. 1 G.P.
	ENHANCED 101
	CLICK TYPE
	WITH HARD COVER
	MANUALS
	HAS CONTROL
	PANEL, LED'S AND
	SECURITY KEYLOCK

### SUPER/TURBO 286-60 "E/T" SYSTEM PRICE COMPLETE \$1999.00

WITH ALL FEATURES ABOVE AND MINISCRIBE 32 MEGABYTE RLL HARD DRIVE SUPER/TURBO 286-30 "E/T" ..... \$1899.00

OPTIONS—ADD:	
MINISCRIBE HARD DRIVES UP TO 380 MEGABYTES	CALL
SECOND SERIAL PORT	\$ 35.00
3.5 INCH FLOPPY SWAP FOR 1.2 OR 360	\$ 98.00
MATH CO-PROCESSOR CHIPS	CALL
COLOR GRAPHICS (CGA) MONITOR W/CARD	\$295.00
COLOR GRAPHICS (EGA) MONITOR W/CARD	\$495.00
MULTISYNC 14" MONITOR W/CARD	\$695.00
(VIDEO CARD IS AUTOTENSE TYPE)	
A \$240.00 RETAIL VALUE ALONE	
HAYES COMPAT. 1200 MODEM	CALL
HAYES COMPAT. 2400 MODEM	CALL

**Use Our Toll-Free Order Number  
800-548-1993**

**AND FOR THE BEST BUY IN XTURBO "E/T" SYSTEMS...TURN THE PAGE**



# Northgate's V20/8MHz XTurbo Is Now Available with 65MB Hard Drive and the same "Enhanced Technology"



NOW...for the buyer who doesn't need 286 speed but wants an XT type system with through-put up to four times faster than other systems, Northgate offers its XTurbo/V20/8-65.

This system also features the MiniScribe hard drive and SMS high speed controller. It is furnished complete with:

V20 Microprocessor • 640K Memory on Motherboard • 360K Floppy Drive • MiniScribe 60MB FAST Hard Drive with 1:1 Interleave • 8 Expansion Slots • 2 Parallel, 1 Serial Port, Clock-Calendar, Game Port • Amber Screen TTL Graphic Monitor with Hercules Compatible Video Card • Northgate "C/T" Click-Tactile 84-key AT style keyboard • Case is the AT style with turbo button, keylock reset button and indicator lights. (Second Floppy Drive pictured is optional at additional cost.)

## Complete System Price: \$1299<sup>00</sup>

Same system with 30MB Hard Drive \$1149<sup>00</sup>

### NORTHGATE GIVES YOU THE MOST POWERFUL CONSUMER PROTECTION WARRANTY IN THE COMPUTER INDUSTRY...

#### 30-Day Compatibility Warranty:

Northgate guarantees its systems will operate any standard, commercially available DOS programs written for use on IBM Compatible Computers. If, on consultation with Northgate, a program cannot be made to operate satisfactorily, owner may return the system, complete and unaltered for a prompt and full refund including all freight costs.

#### One-Year Overnight AT NORTHGATE

**EXPENSE Parts Replacement Warranty:** Northgate Computer Systems warrants that all systems sold by Northgate will be free of defects in workmanship and materials for one year from date of shipment.

In the event of failure of a part that disables the system Northgate will ship, the same day if notified by 12 Noon Central Time, a new replacement part. Customer must phone Northgate Customer Service for diagnosis of the failure.

Shipment of the replacement part will be by overnight express service—AT NORTHGATE'S EXPENSE—for next day delivery depending on the carrier's ability to provide such service in owner's geographic area.

Owner must return any replaced part, complete and unaltered, and pay return shipping costs, to be received at Northgate within two weeks after receiving the replacement part.

Northgate's Customer Service department will provide full instructions on making the repair or replacement and will consult with customer on the phone to assure repair is properly completed and the system is again operating.

CIRCLE 240 ON READER SERVICE CARD

In the case of a complete system returned for repair under warranty, customer pays freight to Northgate and Northgate pays return freight by whatever service the system is sent to Northgate.

In the event of a part replaced under warranty, the new part carries a NEW ONE-YEAR GUARANTEE FROM SHIP DATE!

NOTE: Many computer vendors extend only the parts manufacturer's warranty which may be as little as 30-days. All products sold by Northgate are fully guaranteed by Northgate for one year from date of shipment.

TERMS: Northgate accepts VISA and MASTERCARD charge cards with no surcharge. Purchase orders from established accounts, also accepted as well as COD (Cashiers Check) and Wire Transfer. Personal and Company Checks require 18 days to clear. APO and Foreign orders accepted. All shipments are FOB Plymouth, MN. Delivery is subject to time required for order processing, manufacturing and 24 hour testing.

## Use our Toll-Free Order Number 800-548-1993

Hours: M-F  
8 a.m. - 7 p.m.  
Central.  
Sat. 9-2

### CONSUMER PROTECTION TIP TO PROSPECTIVE COMPUTER BUYERS:

When shopping, remember the Better Business Bureau Motto: "If it sounds too good to be true, it probably is." Exceedingly low prices are your first warning.

Most computer direct sales firms are trustworthy. BUT, better to be safe than sorry.

BEFORE YOU PLACE YOUR ORDER, PHONE THE BETTER BUSINESS BUREAU OFFICE IN THE VENDOR'S AREA. (Your local BBB will give you the phone number for the appropriate office.)



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COMPUTER  
SYSTEMS**  
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**JAMECO COMPUTER KITS** *FREE! PC Write Word Processing Software Included!*

**Jameco's 4.77/8MHz Turbo IBM PC/XT Compatible Kit**



Part No.	Description	Price
4184-150	128K RAM (18 Chips)	\$ 22.50
41254-150	512K RAM (18 Chips)	\$ 54.50
JE1010	Flip-Top Case	\$ 34.95
JE1015	XT/AT Style Keyboard	\$ 59.95
JE1020	150 Watt Power Supply	\$ 89.95
JE1020	5 1/4" DOS/2 Disk Drive	\$ 89.95
AMBER	17" Amber Monitor	\$109.95
JE1011	4.77/8MHz Turbo Motherboard (Zero-K RAM - Includes Award BIOS ROM)	\$104.95
JE1071	Multi VO with Controller and Graphics	\$115.95

**SAVE \$70.70! Regular List \$670.65**

**JE1005 (IBM™ PC/XT Turbo Compatible Kit) . . . . . \$599.95**

**Jameco's IBM™ AT Compatible Mini-286 6/8/10/12 MHz Kit!**



Part No.	Description	Price
JE1043	1.2M/360K Floppy Control	\$ 46.95
JE1015	XT/AT Style Keyboard	\$ 59.95
41254-120	512K RAM (18 Chips)	\$ 71.10
JE1012	Baby AT Flip-Top Case	\$ 66.95
JE1032	200W Power Supply	\$ 89.95
JE1022	5 1/4" High Density Disk Drive	\$109.95
JE1003	Baby AT Motherboard (Zero-K RAM Includes Award BIOS ROM)	\$399.95

**Reg. List \$850.90**  
**SAVE \$50.95!**

**JE1008 IBM™ AT Compatible Kit . . . . . \$799.95**

*All above computer accessories may also be purchased individually*

**IBM PC/XT/AT Compatible Monitors**

**12" Amber Monochrome - TTL Input, High Resolution AMBER. . . . . \$109.95**

**14" RGB Color - CGA Compatible Amber/ Green/Color Switchable, 640x200 Resolution TTX1410. . . . . \$279.95**

**14" EGA Color - EGA/CGA Compatible, 720 x 350 (max.) Resolution TE5154. . . . . \$399.95**

**14" Ultrascan Color - CGA/EGA/PGC/ VGA Compatible, 800 x 560 (max.) Resolution 4375M. . . . . \$579.95**



TE5154

**IBM PC/XT/AT Compatible Keyboards**

- Tactile touch keyswitches
- Switch selectable between PC/XT or AT
- Illuminated Caps Lock, Num Lock and Scroll Lock indicators
- Manual included



JE1015 Picture

**JE1015. . . . . \$59.95**

• Enhanced keyboard layout - 12 function keys - Illuminated LED indicators for Num Lock, Caps Lock and Scroll Lock - Separate cursor pad - Switch selectable between PC/XT or AT - Manual included

**JE1016. . . . . \$79.95**

**IBM PC/XT/AT Compatible Graphic Display Cards**

- JE1050 Mono Graphics Card w/Printer Port (PC/XT/AT). . . \$ 59.95**  
**JE1052 Color Graphics Card w/Printer Port (PC/XT/AT). . . \$ 95.95**  
**JE1055 EGA Card w/256K Video RAM (PC/XT/AT). . . \$149.95**  
**JE1071 Multi VO w/Controller and Mono Graphics (PC/XT) . . \$119.95**



JE1050

**IBM PC/XT/AT Compatible Multifunction and Input/Output Cards**

- JE1060 Input/Output for PC/XT. . . . . \$59.95**  
**JE1065 Input/Output for AT. . . . . \$59.95**  
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JE1065

**Intel Above Board 286 Memory Expansion & Multifunction Boards for IBM PC/XT/AT**

- MB4020 286 Above Board w/512K (Expand. to 2MB). . . . \$369.95**  
**MB4120 286 Multi Above Board w/512K (Expand. to 2MB) . . \$399.95**  
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MB4020

**IBM PC/XT/AT Floppy Disk Drives and Controller Cards**

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**JE1040 360KB (PC/XT) Control. \$ 29.95**  
**JE1022 360KB/1.2MB (AT) Drive \$109.95**  
**JE1043 360KB/1.2MB (PC/XT/AT) Controller . . . \$49.95**



JE1022

**DATARUNES 2400/1200/300 Modems**

- 1200H 1200/300 Baud Internal Modem . . . \$ 79.95  
 2400S 2400/1200/300 Internal Modem . . . \$174.95  
 1200C 1200/300 Baud External Modem . . . \$119.95  
 2400E 2400/1200/300 External Modem . . . \$219.95



1200H 1200/300 Baud Internal Modem

2400S 2400/1200/300 Internal Modem

1200C 1200/300 Baud External Modem

2400E 2400/1200/300 External Modem

1200H 1200/300 Baud Internal Modem

2400S 2400/1200/300 Internal Modem

1200C 1200/300 Baud External Modem

2400E 2400/1200/300 External Modem

1200H 1200/300 Baud Internal Modem

2400S 2400/1200/300 Internal Modem

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# SATISFACTION GUARANTEED OR YOUR MONEY BACK! 8 MHz TURBO-XT

- 640K of RAM
- 360K Disk Drive
- 150 Watt Power Supply
- 4.77 & 8 MHz
- 8 Slots
- Deluxe Keyboard
- Disc Controller

## OPTION A

- High Resolution Amber Flat Screen
- High Resolution Graphics Card
- Parallel Printer Port

ADD \$148

## OPTION B

- Hi-Res RGB Color Monitor
- High Resolution Graphics Card
- Parallel Printer Port

ADD \$298

**\$398**

## OPTION C

- Hard Disk Drive, Cables
- Dual Hard Disk Controller
- 30 MB XT
- 20 MB XT

ADD \$298 ADD \$298

## Turbo-AT

- 640K of RAM
- Expands to 1 MB
- 200 Watt Power Supply
- AT-Style Keyboard
- One Year Warranty
- Clock/Calendar

**\$798**



**200 CPS**

**\$199<sup>95</sup>**

List Price \$649



**RADIX  
LV2015**

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- 200 CPS B-directional
- 17 x 9 Near Letter Quality
- IBM Graphics
- Parallel & Serial

- 16K Buffer
- Adjustable Pusher Tractor
- One Year Factory Warranty
- Limited Quantity

15" wide,  
132 Column

## TOSHIBA P341e

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List Price \$1049



LIMITED QUANTITY

- 180 CPS, 24 PIN
- IBM Emulation
- One Year Toshiba Warranty
- For Tractor add \$99

## 30 MB HARD DISK

Complete Kit with  
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**\$298**

### AT DRIVES

20 MB 30 MB 40 MB

\$198 \$398 \$428

20 MB PC/XT KIT

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## 360K DISK DRIVE

Half Height, IBM Compatible



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- \*Interface Required
- 300 x 300 DPI Resolution
- 8 Pages Per Minute



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1.5 MB RAM \$198  
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Including Free Software

Heyes Compatible 1/2 Slot Card  
On-board Speaker

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2400 External \$169

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- Hi-res EGA Video Card... \$148
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- Non-glare 31 mm Dot Pitch
- 640 x 350, 640 x 200
- EGA, CGA, MDA & HGA
- 100% IBM Compatible
- 256K of Video RAM

## HI-RES RGB

**\$258**

List Price \$299

- 640 x 240 14" Non-glare Tube
- 640 x 200, 18 Colors
- Includes Free Cable & Tilt-n-Swivel
- Manufactured By Samsung

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**CMS Plus**

21 MB Card Hardcard 20 \$338  
43 MB Card Hardcard 40 \$488 \$568 \$828

**NEC**  
MULTISYNC

**\$529**

13" Color Monitor

**MOUSE**



**\$58**

With Software

**MICROSOFT**  
**MOUSE**

Serial or BUS  
**\$118**

With Software

**EPSON PRINTER**

**\$198**



List Price \$299  
LX-800, FX-86e, FX-288e, LQ-800, LQ-850, LQ-1050  
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## NO-SLOT CLOCK

For Your PC-XT (Clone) or Apple



**\$49**

- Uses No Slots
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- Includes Software
- Plug-in Clock Board for PC... \$48

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8087 \$109  
8087-2 \$149  
8087-1 \$199  
80287 \$179  
80287-8 \$249  
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## 3 1/2" DISK DRIVE

FOR YOUR PC/XT/AT

**\$128**

- 720K Disk Drive For Mass Storage or for Down Loading to your Lap-Top Computer
- Requires DDS 3.20
- Includes Mounting Kit

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Price includes monitors, drives, keyboard, — everything

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	\$599	\$999	\$1,250	\$2,450
Base System	PC-XT Compatible Turbo System	PC-AT Compatible Turbo System	PC-AT Compatible Super Turbo	PC-AT 386 Compatible Super Turbo
Intel processor:	8088	80286	80286	80386
Speed:	4.77/8.3MHz	6/10MHz	10/12MHz	16MHz
RAM on motherboard	640K	640K	640K	1024K
Floppy drive:	360K	1.2MB	1.2MB	1.2MB
Power supply:	150W	220W	220W	220W
Keyboard style:	PC-AT 84 Keys	AT Deluxe 101 Keys	AT Deluxe 101 Keys	AT Deluxe 101 Keys
Monitor:	12" high-resolution monochrome graphic monitor with swivel base			
Printer port:	Parallel   Parallel, Serial & Clock Calendar card			
Additional features:	Hercules Compatible Monochrome graphics card			
	Full documentation; 10 Omni Disks preformatted for PC; FREE software			
Mono Graphic System with Seagate Hard Drives				
20MB (65MS)	\$ 939	\$1339	\$1590	\$2790
30MB (65MS)	\$ 997	\$1397	\$1648	\$2848
40MB (28MS)	\$1174	\$1573	\$1825	\$3025
60MB (39MS)	\$1249	\$1649	\$1900	\$3100
EGA Color System				
• Basic System features plus	\$1070	\$1470	\$1721	\$2921
• Enhanced graphics adapter				
• 14" EGA color monitor				
with				
Seagate Hard Drives				
20MB (65MS)	\$1410	\$1810	\$2061	\$3261
30MB (65MS)	\$1468	\$1868	\$2118	\$3319
40MB (28MS)	\$1645	\$2045	\$2296	\$3496
60MB (39MS)	\$1720	\$2120	\$2371	\$3571

TERMS: MasterCard, VISA, Money Orders, Certified Checks, Personal Checks (Allow 10 days for processing), C.O.D.'s and Approved Company University Government Purchase Orders. All prices are subject to change and quantities may be limited.

One year limited warranty—Covers parts and labor. We will repair or replace, at our option, any product that fails due to defects in materials or workmanship within one year from date of shipment. Items must be returned prepaid, insured, and bear our return authorization number.

30 Day money-back guarantee—Any item may be returned within 30 days of shipment for a full refund. Items must be returned in original packing, undamaged, shipped prepaid and insured, and bear our return authorization number.

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- CUSTOM CONFIGURATION

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## PRISM

Prism Technologies, Inc.  
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(617) 865-0211  
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## Seagate 49 MB disk card



\$579

Here's a hard disk card with a combination of speed, capacity, low power consumption, and extra features that define a whole new class of value in PC mass storage.

**SPEED** A stunning 28msc. average access, with track to track access of just 18msc. Data transfer is enhanced by a high speed 7.5 Mbps Western Digital RLL controller.

**SIZE** A total of 49.1 MB formatted capacity. It's preformatted into 24 MB partitions with average access around 20msc. Just plug it in, transfer your DOS files over and your PC, XT, or compatible is screaming.

**LOW POWER** Just 10 watts of power means less strain on the power supply and lower operating temperatures inside the system.

**EXTRA FEATURES** A 1 year warranty, and 30 day money back guarantee. We include a head parking program and **TakeTwo**, the backup utility PC MAGAZINE has named its editors choice two years in a row!

CIRCLE 184 ON READER SERVICE CARD

## 1200 internal modem

\$69



- Short slot size
- 300 or 1200 bps speed
- Hayes Smartmodem II compatible
- Line-busy detect and auto redial
- MicroC II software a \$69 value
- Made in USA by Franklin Telecom
- 1-year warranty

1200 External with Mirror II \$99

## 768K mini ems

\$179



- 768K of 120ns RAM
- Lotus/Intel/Microsoft compatible
- Can backfill to 640K, remainder as EMS
- Short slot card
- \$1 MB plug-in board option \$189
- 1600x window print spooler, and RAM disk software

## 3 1/2" floppy kit



Instant Laptop & PS/2 compatibility. All kits include bracket to mount in 5 1/4" drive bay, black & grey face plates, and mounting rails. 144MB XT kits include replacement floppy controller that doubles the data transfer rate.

Now included **TakeTwo**, the backup utility PC MAGAZINE named as their Editor's Choice. Now you have a fast, affordable backup solution that brings you media compatibility with the latest IBM PS/2 systems.

**720K Internal for PCXT/AT, \$119**

- Requires DOS 3.2 or optional \$15 driver software

**1.44MB Internal for AT only, \$149**

- Includes driver software

**1.44MB Internal for PCXT, \$249**

- Floppy Controller & cables with 500,000 bit per second data transfer rate.
- Supports two drives.

**External Case for XT kits add \$99**

## PC/XT hard disks

- Drive & Controller pretested & formatted
- Genuine Western Digital Short slot controller
- 30 page installation guide & reference manual
- Cables, mounting screws, full & half-height bezels
- **TakeTwo** Backup Software, PC MAGAZINE Editors' Choice
- 1 year parts and labor warranty
- 30 Day Money Back Satisfaction Guarantee
- Optional: 150 watt, UL/PC approved power supply \$69

Tandy 1000 kits add \$20

**Shamrock**

2524B Townsgate Rd., Dept P  
Westlake Village, CA 91361  
TOLL FREE 800-722-AT-XT  
California 805-373-7847

No extra for Visa/MasterCard  
Prices include UPS Shipping & Insurance  
30-Day Money-Back Guarantee  
Corporate & Institutional PQ's accepted

## Paradise Autoswitch 490



\$199

- EGA, CGA, VGA, & Hercules Compatible
- Short Card, 5.25" long
- 2-year warranty
- 640x480 resolution
- 152-column Lotus 1-2-3, Symphony, etc.
- ISA-640 & NEC MultiSync II \$760

## TakeTwo



## 20 MB kits

\$299

- Seagate ST225—214 MB/65 ms./Half-height/14 B Watts

## 30 MB kits

\$339

- Seagate ST238—315 MB/65 ms./Half-height/14 B Watts

## 40 MB kits

\$487

- Seagate ST251—428 MB/Half-Height/11 Watts
- Pre-formatted into a pair of 21 MB partitions, 28ms.

## 40 MB kits

\$399

- Miniscribe 3650—42 MB/Half-Height/16 Watts
- Pre-formatted into a pair of 21 MB partitions, 42ms.

## 65 MB kits

\$599

- Seagate ST278—65.5 MB/Half-height/11 Watts
- Pre-formatted into a pair of 32 MB partitions, 28ms.

## 2400 MNP modems



\$239

- Hayes Compatible
- 300/1200/2400 Speeds
- MNP level 4 error correction increases throughput up to 20%
- Automatic Adaptive Equalization
- Non-volatile memory retains configuration
- MicroC II software, a \$69 value
- Internal fits in short slot
- PCXT/AT/PS2 Modem Cable \$15 (specify model)

## FAX Modem



\$499

- 9600 bps Operation
- CCITT Group 3 compatible
- Send ASCII or word processing files
- Background receiving
- Unattended sending & receiving
- Prints on Eison or Laserjet compatible printers
- Use as 9600 bps synchronous modem with other FAX/Modem
- Requires ST2K, Hard Disk, DOS 3.x, & Hercules mono or color graphics adapter

## WESTERN DIGITAL

## 30MB filecard



\$399

- 32 Mega-bytes, 62 msec Access
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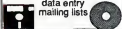


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## COMING UP

**WORD PROCESSING ISSUE** As one of the big five productivity tools, word processing merits our undivided attention. Thus, next issue we launch a comprehensive review of word processors in a thorough, hands-on, insightful analysis of over 50 programs ranging in price from under \$15 to over \$700.

Contributing editor Jim Seymour sets the stage with a discussion of the state of the art and the condition of the market. He assesses the push that word processing vendors are making into the desktop publishing industry, the lively competition between *WordPerfect* and *Microsoft Word*, and the growing interest in "intelligent" word processors, which record and then mimic a writer's style. Then PC Labs and our editorial staff put the programs through their paces.

**HANDS-ON TESTING** Each package is gauged on how quickly it can load a test document, save it, and return control to the keyboard. Block define, move, and copy tests measure how well each program handles these common but essential tasks. Printing speed is measured, and scores of features are tabulated for easy cross-comparison of those aspects that mean the most for the word processing applications you need to perform.

The results of the testing are exciting. Vendors have added new features and enhanced old ones. Today's word processors are able to perform communications functions, generate tables of contents and indexes, support proportional spacing, and much more. We sort it all out for you. We even tell you how well each program performs in five different environments: corporate, professional, personal, legal, and desktop publishing.

Our report will continue in the following issue with a look at 18 integrated word processors, both high-end and low-end products that are combined in an integrated program with at least two of the other four "big five" applications: spreadsheets, database management, communications, and graphics. Later in the year we'll be looking at scientific and technical word processors.



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# AFTER HOURS



GAMES

## Big Risks and Slow Payoffs: Two Views of The Stock Market

BY DONALD B. TRIVETTE

October. This is one of the peculiarly dangerous months to speculate in stocks. Others are November, December, January, February, March, April, May, June, July, August, and September.

—Mark Twain

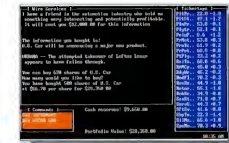
Even observers from the 19th century agree that the best way to enjoy the stock market is from the safety of the sidelines. The *Wizard of Wall Street* and *Inside Trader* allow you to keep your money in your pocket and enjoy the excitement.

### Life in the Fast Lane

*Inside Trader*, from Cosmi, bills itself as a realistic simulation of inside trading on Wall Street and challenges you to make millions of dollars without going to jail. You start with \$50,000 and a screen divided into three windows. A ticker-tape window displays current stock prices; a command window allows you to enter commands like buy, sell, and bribe; and a wire-service window brings you insight into your fictitious world: "The Commerce Dept. has revised its aerospace industry forecast, up 4 percent," and "A forest fire has devastated the holdings of Rainier Timber."

Using these subtle indicators, you are supposed to buy stocks in the aerospace industry and shy away from investing in Rainier. Safe, but neither exciting nor a quick way to riches.

Every now and then a message that appears on the wire service offers a truly hot tip. Never mind that real insiders don't whisper secrets over the



Inside Trader offers to sell hot tips to the greedy investor. Can you make money and stay out of jail?

financial wire; right on your screen in black and white it says: "I have information about an upcoming announcement in the drug industry. It will cost you \$10,000 for this information." Now who can resist inside information? (I suspect a lot of us would if the price were \$10,000.) If you're willing to bite, type **PAY**. *Inside Trader* debits your account and then tells you that Apothomed will soon report large profits. You rush to buy Apothomed—as much as you can afford—and wait.

Sometimes the Securities and Exchange Commission investigates. You can cooperate and be fined double the amount of money you made; or you can hope the charges are dropped; or you can destroy the evidence. If caught at the paper shredder, the penalty is jail and termination of the game.

*Inside Trader* is managed by weighted random numbers, and the odds are explained in the back of the manual. Destroying evidence will land you in jail seven times out of ten.

I didn't get pinched, but with Apothomed selling at a quarter of its former value—a tipster lied—I think I would have felt better in jail. It's not easy to be an insider.

### The Old-fashioned Way

*Wizard of Wall Street*, from Synapse Software, rewards pa-

tience and perseverance and discourages tips and inside trading. You begin in January 1990 with \$50,000; a skill level of novice, investor, or wizard; and a list of fictitious companies. For each company, you may purchase research reports that contain financial information, including recent high and low stock prices, estimated earnings per share, estimated growth, and something that is called the Beta factor, which is a measure of a stock's volatility relative to the overall market. The higher the Beta factor, the riskier the stock. From these factors, from news flashes, and from the overall condition of the market as it's graphed across the screen, you make selections about trading options or buying

and shorting stocks (he who sells what isn't hidden must buy it back or go to prison).

The idea is to trade and to base those trades on research and insight. Each trading day takes about 10 seconds, and at the end of the month the program pauses to present a summary of your account along with a market overview. You may decrease the playing speed—a choice I highly recommend if you choose the risky business of trading options.

*Wizard of Wall Street* is a fun way to learn about the real stock market and its operation, while *Inside Trader*, although not quite living up to its realistic billing, does illustrate raw greed and the kinds of behavior that generally lead to federal indictments.

List Price: *Inside Trader*, \$24.95.

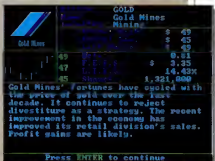
Requires: 256K RAM, one disk drive (hard disk drive recommended), CGA or EGA, DOS 2.0 or later. Not copy protected. Cosmi, 415 N. Figueroa St., Wilmington, CA 90744; (213) 835-9687.

CIRCLE 638 ON READER SERVICE CARD

List Price: *Wizard of Wall Street*, \$14.95. Requires: 128K RAM; one disk drive; EGA, CGA, or Hercules graphics; DOS 2.0 or later. Not copy protected. Synapse Software Inc. 17 Paul Dr., San Rafael, CA 94903; (415) 492-3500.

CIRCLE 637 ON READER SERVICE CARD

This research report from Wizard of Wall Street suggests that a gold-mining stock, with its long-term growth potential, might make a good investment.







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# AFTER HOURS

2  
4

## EDUCATION

### From Simple Addition To Quadratic Equations, Algebra Plus Helps Students Subtract the Mystery From Math

BY CAROL ELLISON

Remember algebra class and those mimeographed tests your teacher used to pass out—the ones your classmates held to their noses, breathing deep? Forget about the smell for a moment and try to remember what was printed on those papers. Now you've got some idea of what you'll find in *Algebra Plus*, Numbers 1 and 2, educational software programs from Stone & Associates of La Jolla, California.

*Algebra Plus* is designed to be a classroom aid, though it could also serve students seeking additional help in the subject. It essentially puts a mimeo sheet of problems and short explanations on your screen. It is sold in two volumes, *Algebra Plus*, Number 1, and *Algebra Plus*, Number 2. Each comes with two disks. One disk contains simple tutorials and problems; the second contains tests and a glossary of mathematical

terms. *Algebra Plus* 1 contains 12 lessons and begins with simple addition and subtraction, takes you through the real number system and sets, and winds up with an introduction to polynomials. *Algebra Plus* 2 contains 11 lessons; it picks up with polynomials and ends with quadratic equations.

Each lesson addresses a subject area you'd encounter in an algebra class. The programs offer brief explanations of algebraic concepts, but Stone & Associates advises you to use an algebra text ("textbook," as it's spelled in the accompanying literature) as you work your way through the problems.

There is no real documentation—just a staple-bound pamphlet printed on colored stock (blue in *Algebra Plus* 1, green in *Algebra Plus* 2), and not unlike construction paper) that accompanies each program. These are supposed to tell you how to install the program, but they are full of errors, and anyone with little or no knowledge of DOS would get nowhere.

Academically, the *Algebra Plus* programs perform their tasks well. They present short tutorials on each subject and follow with problems on the material. They present numeric and word problems, check a student's answer, tell him whether he's right or wrong, and keep a running score of his performance. For the teacher, the pro-

grams offer a glossary of 160 mathematical terms (though they give only the terms and not the definitions), as well as tests on the lessons that are outlined on the disks. You can save the test results to monitor a student's progress. And because tests and glossaries are kept on the second disk, away from the lessons, you can hand the lesson disk to a student without worry-

calculations that produced it.

The screen display is weak. On a CGA monitor *Algebra Plus* comes up in washed-out pastel colors—white characters with a pale pink highlight against a pale blue background—and you can't change the default. The contrast was better on an EGA monitor, on which the pink became red.

What's disappointing here is

As you answer word problems, *Algebra Plus* shows you the correct answer and equation. If you do the problem again, the program changes the numeric values so that you must recalculate to find the new answer.



ing that he'll see the problems for the next day's test or the list of terms that will appear on the glossary.

If students become stumped on any of the problems in the lessons, they can enter H instead of an answer and the program will help them through the problem a step at a time.

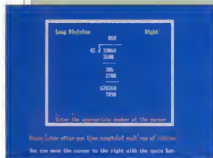
*Algebra Plus* could be a wonderful instructional aid, but it isn't foolproof. There are some minor annoyances. If a student presses the Spacebar before entering a correct answer to a problem, the program reads the blank as a number and tells the student that he's wrong. When we entered 24 digits as an answer to a problem that called for a 6-digit answer, the program gave us an error message saying "overflow in module MATH8" and exited back to the DOS prompt; we had to restart the program. In a lesson on long division, the program accurately checked for the right answer but did not check the

that Stone & Associates neglected the details that could have made *Algebra Plus* a great program. Any average computer science student could assemble better documentation and more-complete installation instructions than you'll find here.

Nevertheless, the real test of educational software is its quality of instruction, and the *Algebra Plus* series gets high marks there. At \$49.95, it is an excellent value that can, as it claims on its cover, go a long way to "help pre-algebra and algebra students take the 'misery' and the 'mystery' out of learning 'how to.'"

**List Price:** *Algebra Plus*, Number 1, \$49.95; *Algebra Plus*, Number 2, \$49.95. **Requires:** 128K RAM, one disk drive, CGA or EGA graphics, DOS 2.0 or later. Not copy protected. Stone & Associates, 7910 Ivanhoe Ave., #319, La Jolla, CA 92037; (800) 621-0852, ext. 520.

CIRCLE 630 ON READER SERVICE CARD



*Algebra Plus*, Number 1, checks for correct answers, but it does not check your math in the lesson on long division. Here it overlooked the non-zero values at the end of the problem.



# Tax Preparer is not for everybody.

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*"My return is backed up with  
the kind of thorough detail  
the IRS likes to see."*

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# AFTER HOURS



## EDUCATION

### Stepping Stones: Learning from Pictures

BY GUS VENDITTO

If your 4-year-old has already exhausted the "Big Bird Touch and Talk" toys she got for Christmas, *Stepping Stones*, from Compu-Teach Educational Software, could be the best next plateau—although this two-part series probably won't carry her through to first grade. However, it can introduce your child to computer and language skills at the same time, while keeping the lessons fun.

The graphics-based program aims to give children an association between words and pictures, as well as between math concepts and finite objects. Too-cute music dramatizes right and wrong choices, but ex-

selecting the correct letter; ugly buzzing sounds meet the wrong choice.

In *Stepping Stones II*, addition and basic reading skills are rehearsed, using the same CGA picture files and oversized text seen in the first program. At least one of the lessons may unnerve attentive parents: "Salt is good. Is salt good? Yes, blank is good," the game proposes; children can choose among a picture of a truck, a stamped envelope, a salt shaker, or a clock. You'd probably want your kids to choose anything but a salt shaker here, but such are the risks you take whenever you send your children out into the cold world. None of the other lessons raise any controversial topics.

*Stepping Stones* uses the Spacebar and Return key for all choices, so kids won't be overwhelmed by the keyboard. The series seems to have struck the right balance between teaching simple concepts and keeping kids entertained.



Cheerful pictures reward choosing correct answers: here, the challenge was to fill in the first letter in "tin."

cellent animation techniques will keep even parents amused as trucks roll, spiders crawl, and birds fly off the screen.

Separate programs cover two levels. *Stepping Stones I* helps with learning to count and identifying simple words like *tin*, *dog*, and *bar* by choosing the first letter. Pictures reward

**List Price:** *Stepping Stones I*, \$39.95; *Stepping Stones II*, \$39.95. **Requires:** 128K RAM, one disk drive, CGA graphics, DOS 3.0 or later. Not copy protected. Compu-Teach Educational Software, 78 Olive St., New Haven, CT 06511; (800) 44-TEACH.

CIRCLE 641 ON READER SERVICE CARD



Menus lead you through each Uptime issue; the programs are simple to learn and rarely require documentation.

## ART & LEISURE

### Uptime Delivers Games, Utilities, and Articles Monthly

BY JONATHAN MATZKIN

The home computer market hasn't transcended its TV game origins because most people have no real use for computers in their homes. Of course, lots of people polish corporate reports in their living rooms, but that amounts to an extension of the office rather than true home computing.

When the home computer does catch fire, software—something for home users to do with the thing—will provide the spark. *Uptime*, a disk-based magazine from Viking Technologies, just might ignite a flame or two. Each monthly disk has plenty to keep even the workaholic interested until the next installment arrives.

A year's subscription to *Uptime* costs \$89. Each disk has a main menu that gives access to an assortment of articles, programs, games, and tutorials.

The best thing that *Uptime* does is provide simple software that runs immediately—with no

compiling or learning curve. Volume 1 Number 7, for example, offers a pretty functional little word processor. The same issue has a checkbook organizer, and Volume 1 Number 1 has a database to help organize household possessions.

Most of the software that *Uptime* offers is modest in its intentions and usefulness. And you won't find the slick interfaces and powerful features that premium software offers.

In short, you will outgrow some of the programs, but many of the small utilities are keepers—such as ImagePrint, which produces letter-quality print from a dot matrix printer by forcing up to six passes.

Of course, each issue has some purely recreational content. Games range from trivia quizzes to complex outer-space strategy games.

If you've got a family computer that's running little more than office work, slide in an issue of *Uptime* and watch what happens.

**List Price:** *Uptime*, \$89 for 12 monthly issues. **Requires:** 256K RAM, two disk drives, DOS 2.0 or later. Some features require CGA. Not copy protected. Viking Technologies Inc., The Travers Block, 174 Bellevue Ave., Newport, RI 02840; (401) 847-2455.

CIRCLE 640 ON READER SERVICE CARD

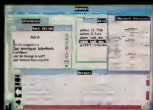


Even the  
fastest, newest,  
cleverest  
machines lack  
one minor  
feature.

A soul.



# Applications keep pouring in for the Windows office.



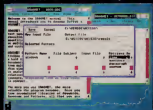
**Nexpert Object**, AI graphical expert system application, Neuron Data.



**The Network Courier**, electronic mail application, Consumers Software, Inc.



**PC Paintbrush**, color design and graphics application, ZSoft Corporation.



**Dragnet**, text retrieval application, Access Softtek.



**Microsoft Excel**, spreadsheet application, Microsoft Corporation.



**PageMaker**, desktop publishing application, Aldus Corporation.



**Guide**, hypertext application, OWL International, Inc.



**CheckStart!**, applications organizer application, hDC Computer Corporation.



**In'a'Vision**, intermediate CAD application, Micrografx, Inc.



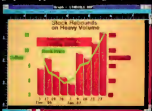
**Scrapbook**, art images application, T/Maker Company.



**Omnis\* QUARTZ**, multi-user database application, Blyth Software, Inc.



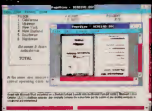
**Windows DRAW**, presentation graphics application, Micrografx, Inc.



**Windows GRAPH**, business graphics charting application, Micrografx, Inc.



**Windows Mail**, electronic mail application, DaVinci Systems.



**Microsoft Pageview**, page preview/graphics integration for Microsoft Word.

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